ANNALS OF SURGERY

VOL. LV MARCH, 1912 No. 3

ORIGINAL MEMOIRS.

INDICATIONS FOR AND AGAINST THE OPERATIVE TREATMENT OF SIMPLE FRACTURES.*

BY JOHN H. GIBBON, M.D.,

OF PHILADELPHIA,

Professor of Surgery in Jefferson Medical College; Surgeon to the Pennsylvania Hospital.

WHAT I have to say on this important subject will probably cause my readers to place me among those who oppose the operative treatment of simple fractures; and although I should prefer this to being classed with those who recommend operation in practically every case, yet a careful consideration of what is said I believe will show that I belong in neither class. There has been so much written on the open treatment of simple fractures, and the technic has been so much improved lately, that I am afraid we have become too sanguine in regard to our results and too radical in both our teaching and practice. It is important to bear in mind that what follows has to deal only with simple fractures.

The first desideratum in the treatment of a fracture is the restoration of function, and the first step in accomplishing this objective is complete reduction and retention of fragments. Although improper reduction is one of the chief causes of loss of function, injury of the surrounding soft parts and the resulting adhesion of muscles and tendons is just as potent a factor, and when the open treatment is employed there must be more or less injury and adhesion of

* Read before the Philadelphia Academy of Surgery, December 4, 1911.

these structures, which will be in proportion to the mechanical and technical skill of the operator and the perfection of his asepsis. It is extremely important to bear these facts in mind before undertaking the open treatment of a simple fracture.

There are, of course, certain indications for the open treatment which we all recognize and follow, unless they are outweighed by equally positive contraindications, which will be considered later. In the first place, the situation of the bone or the type of the fracture may be a sufficient indication for operation; this is the case in fractures of the patella, in many fractures near a joint, in an epiphyseal separation which cannot be perfectly reduced, in some comminuted fractures, in those where a muscle or tendon or other tissue is interposed between the fragments, where a nerve-trunk has been caught under one of the fragments, and in all fractures where a fair reduction has not been obtained *after the exhaustion of all rational non-operative means.* Emphasis is laid on this last condition, especially with students and those who look too lightly upon the risks of operative treatment. I say this because it is the beginner or the occasional operator who is often willing to run risks which the most experienced operator never runs, and neglect precautions which an experienced operator always takes.

One of the most valuable lessons which experience teaches is the estimation of risks and the value of precaution. It is the tyro whose boldness causes him to operate where an experienced surgeon recognizes danger, and it is the tyro who considers the refinements of an aseptic technic unnecessary or even looks upon them as fads. It is this type of surgeon who will operate on a fracture without having exhausted the less dangerous non-operative means of reduction, and one reason why he does so is because he sees many worse cases operated on successfully by others. It may be said that this applies to the whole field of surgery, and so it does, but I hold that it applies particularly to the open treatment of fractures, where success depends so largely on the operator's mechanical skill and his practice of an aseptic technic.

A conscientious practice of the rule of exhausting the non-operative means of reduction will obviate the necessity of operation in many so-called irreducible fractures. To prove this statement, one has but to consider a few types of fracture for which operation is frequently employed. First, let us take fracture of the surgical neck of the humerus with abduction and external rotation of the upper fragment, a fracture which by the older methods of reduction and retention gives but a limited restoration of function and a very indifferent restoration of contour. A mistake commonly made here is that of trying to control the short upper fragment, which is practically uncontrollable, instead of placing the lower fragment or shaft in alignment with the displaced and uncontrollable upper fragment. In many of these cases the simple abduction of the arm with moderate traction even without an anæsthetic will result in an excellent reduction, which can be maintained by dressing the part in abduction on a triangular splint placed against the chest wall, the inner aspect of the arm, and the flexor aspect of the forearm; or by keeping up extension in the abducted position by placing the patient in bed and applying a Buck extension apparatus to the arm. Too frequent an error in these cases is that of fixing the arm against the chest wall and applying a bandage, usually a Velpeau, which makes upward pressure on the flexed elbow and downward pressure on the shoulder; in other words, a dressing which tends to crowd the fragments into angulation or to retain them in this malposition. Traction applied to the elbow with the arm against the chest wall also often corrects the deformity when operation may seem to be necessary. In a number of these cases where there was extremely bad position of the fragments, we have obtained a fair reduction and excellent restoration of function by keeping the patient in bed with an extension on the arm in the abducted position for a week or ten days, and then dressing the part on a triangular splint.

Transverse fractures of the humerus with overlapping can nearly always be reduced by continuous traction applied

to the flexed elbow, with fixation of the arm to the chest wall while the patient is in the upright position, or, what is better, by keeping the patient in bed and applying extension by means of a Buck apparatus. Counter-extension should be made, of course, by elevating the foot of the bed and fixing the upper arm to the head of the bed by means of a pad and strap passed under the axilla. In the oblique and spiral fractures of the humeral shaft, the type of fracture which most frequently requires operative fixation, the large majority can be reduced by the method just described. If it fails, probably due to the interposition of the soft parts, then operation is plainly indicated. The necessity for operation in supracondyloid and fractures of the condyles can often be obviated by the proper employment of the Jones position, which gives excellent functional results, although not such perfect contour as can be obtained sometimes by other forms of dressing and by operation.

Many fractures of the olecranon require operation because of the wide separation of the fragments and the extensive laceration of the ligaments. But here the simplest means possible should be employed; catgut suture of the ligamentous tissue, as in fracture of the patella, may be sufficient, and a plate in this position is seldom excusable.

In certain fractures of the shaft of the radius and of both bones of the forearm, we encounter some of our greatest difficulties, and may be driven to operation or to accept some deformity with considerable loss of function. In four or five such cases within the past twelve months I have been surprised and gratified to find what can be accomplished by continuous traction extending over a period of from two to ten days. One of the cases at the Jefferson Hospital, X-ray plates of which are shown, was most obstinate (Figs. 1 and 2). My assistant, Dr. Despard, twice tried under ether anæsthesia to reduce this fracture, but the overlapping radial fragments could not be put into line. He then applied a Buck extension apparatus below the fracture, fixed the upper arm to the head of the bed, and elevated the foot of

the bed. This treatment, kept up for three days, had little apparent effect on the deformity, and the boy was then anæsthetized with the understanding that I would operate if failure again accompanied efforts at reduction. The treatment had done so much to overcome and stretch the muscles that without much effort reduction was accomplished, and the boy, now eight months after the injury, is playing on a football team, has perfect function, and it is impossible to tell by examining the arms which was the seat of fracture. In another case of overlapping of both bones of the forearm sent into the hospital from the out-patient department, where various efforts had been made at reduction and in which about ten days had elapsed since the injury, treatment by continuous traction for about two weeks resulted in fair reduction and good union. The ultimate restoration of function I have been unable to determine in this case. Other cases have responded much more quickly to the treatment, but these two were cases in which operation seemed inevitable, even after traction had been kept up for several days. This method of overcoming the indications for operation will not work in every case, but it should be tried faithfully before resorting to the open method, which certainly does not give its best functional results in fractures of the forearm and makes a scar which is disfiguring, especially in women. The bones here are closely surrounded by important structures which are apt to become bound down in the cicatrices; the bones are delicate and do not put up with the plates and screws so well as the more deeply situated and larger bones.

The femur is the bone upon which we most frequently have to operate, and yet as the results here cannot always be expected to be perfectly satisfactory, we should by every possible means try to obtain reduction before operating. In children, especially, persistent effort and time will do wonders in restoring the bone to approximately normal lines, and the functional results are often excellent even in the presence of considerable deformity. I have nothing particular to offer here as a means of avoiding operation in the adult, but I would

call attention to the fact that in fractures of the upper third of the femur which are so troublesome because of the difficulty of controlling the upper fragment, extension in the abducted and elevated position has not been given one-half the employment it deserves. Most of us use this position in children, but many fail to realize its advantages in the adult. I have had as many as three of these cases in my ward at the Pennsylvania Hospital at one time upon which I have operated, but since I have used the extension with a little more care and discrimination, and less according to rule, I have operated on fewer cases.

Of fractures of the patella I shall say but a word, as I believe that the indication for operation is clear if the fragments are separated, since bony union of the patella and good healing of the lateral ligaments will rarely take place without it. I have never operated on a fracture of the patella without finding the ligamentous tissue firmly adherent over one or the other of the fractured surfaces. The contraindications will be referred to later.

In fractures of the tibia of the oblique and spiral types, operation is frequently demanded, and yet I am confident that too many of these cases are submitted to operation, especially at the hands of inexperienced men, where better results could be obtained by non-operative methods. I admit that continued improvement in technic may cause me to change my opinion and practice, but I speak now rather from the point of view of a teacher of undergraduates. Greater care, personal effort, the proper use of extension, and constant watching of these cases, which we are apt to turn over to entirely inexperienced internes, will certainly keep out of our operative lists many of these cases. Here, particularly, the operator should understand that if after exposing the fragments he can reduce and maintain them in reduction by a proper dressing, he should not employ a plate or other mechanical device applied directly to the bone, as such is badly borne by the tibia on account of its thin covering. Non-union, especially where the position is bad, is a definite indication for operation, but the best operative results are obtained when

the operation is done early; that is, as soon as it is evident that reduction cannot be accomplished. The open treatment of a Pott's fracture is rarely required except in old neglected cases, and here again the situation is not one suited to the use of a plate, the simpler methods of suture, nailing, etc., being better. The word "neglected" is used advisedly, because in the large majority of cases reduction can be accomplished and maintained with the expenditure of but a moderate amount of care. A certain proportion of Pott's fractures apparently heal in good position, and then the deformity recurs after the patient begins to bear his weight upon the part, and it is this type of case which is most frequently submitted to operation. The redevelopment of the deformity can easily be avoided by following a suggestion made by Mr. Robert Jones, of Liverpool, who, when the patient begins to walk, sees that the inner portion of the heel and sole of the shoe is slightly raised; this gives the ankle an outward turn and prevents stretching of the recently healed ligaments. If every patient upon leaving our wards is instructed to have his shoes altered in this way for six months, there will be fewer cases operated upon in the future than in the past.

Just as I have tried to show that continued traction will often result in reduction where spasmodic and intermittent traction will not, Crile has suggested that with deep anæsthesia, which causes complete muscular relaxation, our attempts at reduction will be far more successful than when we simply employ the anæsthetic to the point of relief from pain and the production of unconsciousness.

The contraindications to the operative treatment may lie in the fracture itself, in the patient's general condition, or in the operator and his surroundings. The contraindications to be found in the fracture itself are few, if, after careful and intelligent effort, reduction has not been accomplished and enough deformity exists to interfere with subsequent use or to distress the patient by its appearance. Local disease and infection of neighboring structures may preclude operation. I have at the present time a fracture of both bones of the forearm, in which there is an infected wound communicating

with the ulna, which is in excellent position, and I am prevented from operating on the radius, the fragments of which are overlapped, because of the infection in its neighborhood.

The indications against operation to be found in the patient's general condition are those which would make one hesitate to perform any operation of election. All these, however, must be considered carefully, and they should often make us refrain from operation on a broken bone when we might operate for some other condition in which infection is less likely to occur, more readily overcome, or less disastrous in its results. A drain may, for instance, save another structure from infection, but we have learned that it has no place in the open treatment of simple fractures, rather inviting than preventing infection. My experience has taught me to look upon chronic alcoholism as a contraindication deserving of great attention, as is also an old syphilitic infection. The extremes of age may often constitute a contraindication, old age because the operation is more dangerous, and childhood because nature does so much in the subsequent growth of the bone to overcome the deformity resulting from fracture. The ultimate results secured in children, even where reduction was but partially obtained, were clearly shown in a series of pictures recently exhibited by Dr. Edward Martin before the Philadelphia Academy of Surgery. The accompanying picture (Fig. 3) of a spiral fracture of the femur in a five year old boy is one in which I expect to get a good functional result, even though I may fail in correcting the position. Such a fracture in an adult I should probably be obliged to subject to operation.

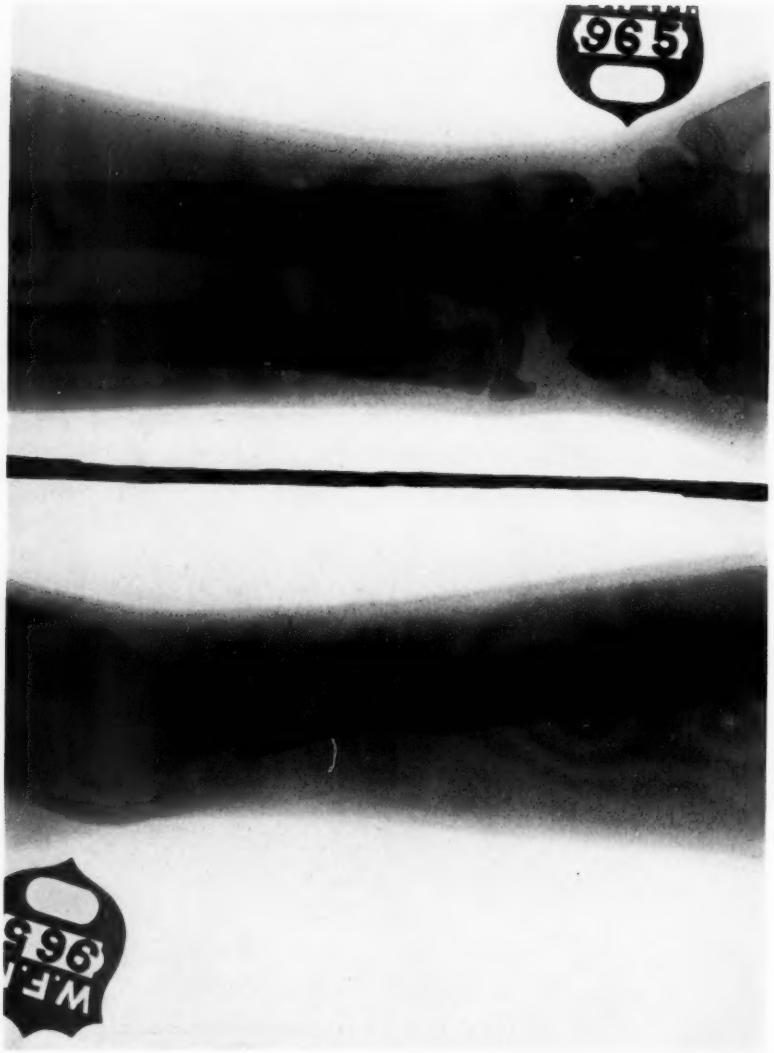
I also show plates of a bad fracture of the femur in an adult, when, in spite of the displacement of the fragments, an excellent functional result without apparent limp was obtained (Fig. 5).

The contraindications to be found in the operator and his surroundings I would emphasize. There are probably but few surgeons who operate upon fractures with the same impunity and confidence that they perform other surgical operations of an apparently more serious nature. If this is true, it behooves us to know the reason. First, I take it, the

FIG. 1.

Fracture of both bones. Radius unreduced after two attempts under anæsthetic. Readily reduced after continuous traction of three days.

FIG. 2.

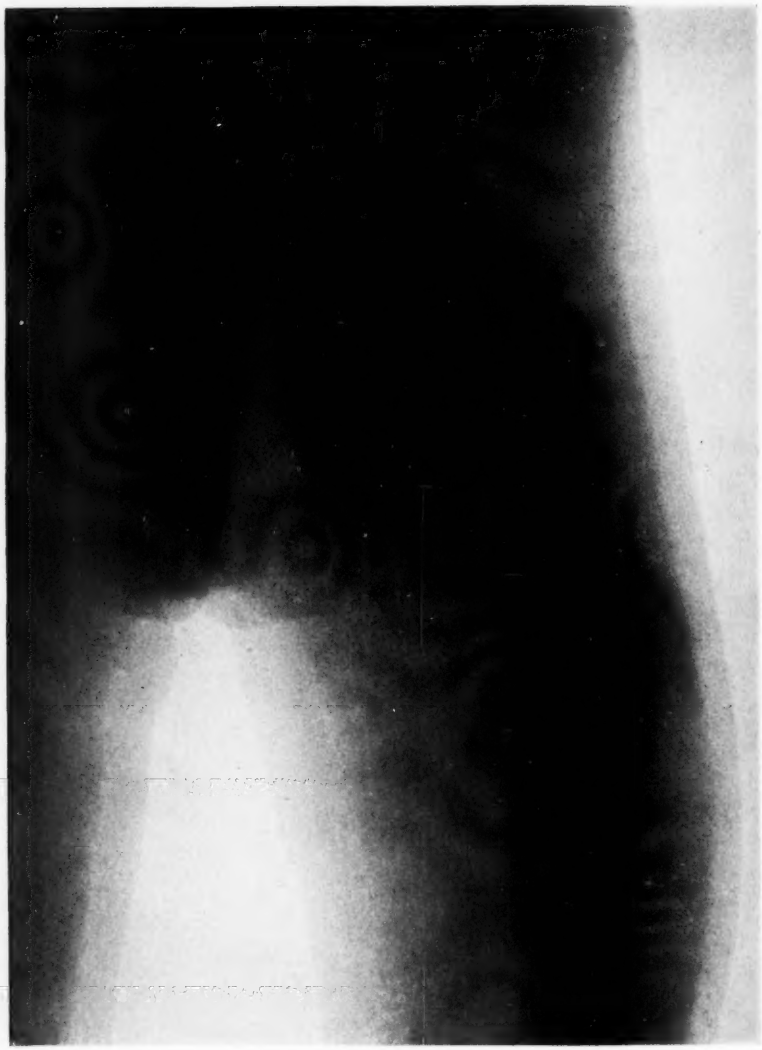


Same case as Fig. 1, eight months after injury.

FIG. 3.

Patient admitted to Pennsylvania Hospital November 27, 1911. Discharged January 18, 1912.

FIG. 4.



Same case as Fig. 3, taken ten weeks after injury. Excellent functional result.

FIG. 5.

Patient admitted to Pennsylvania Hospital December 17, 1911. Discharged February 8, 1912, on crutches.

FIG. 6.

Same case as Fig. 5, taken one week before discharge. Shortening 2.5 cm. Excellent functional result.

required mechanical skill is of a different sort from that necessary to the successful performance of most of the surgical operations, even of the most delicate character, and this is acquired only by careful study of the methods in vogue and by much experience; again, more care is necessary in this field than in any other to avoid infection, as we are dealing with a tissue, the medullary portion of the bone, whose resistance is slight; and still further, it may be said that failure of the operation often leaves the patient in a worse state, a greater cripple, than if no operation had been done. No one realizes these facts more fully than he who does the greatest amount of work in this field, and consequently when we are inclined to imitate the accomplishments of others, we should see that we are equipped at least to some extent as they are, and by equipment I do not mean the special instruments which are, however, most essential, but rather with ability to meet and deal with difficulties and with an aseptic habit and an environment which can be relied upon. If we could feel the same assurance regarding aseptic wound healing in fractures as we do in abdominal operations, half of the difficulties of this work would be overcome, and our results would be ten times better than they are at present. We are apt to minimize our percentage of infections in any type of operation, but I ask a careful study of our own cases and the perusal of any honest report by others, and we will then find that this important question of infection takes first rank when it comes to the open treatment of fractures. In a recent article on this subject, Lund, modestly describing himself as a beginner, reports eleven cases in which he has used the Lane plate, and in four of these he was obliged to remove the plate. If a man of his experience and ability finds this work difficult, it then becomes those with less experience and ability to move in this field of surgery with judgment and precaution.

In concluding this rather discursive paper, I would say that our aim should be to overcome the indications for open treatment by a perfection of our mechanical measures, and to obtain better results when we must operate by improving our operative technic.

THE TREATMENT OF SIMPLE FRACTURES: A STUDY OF SOME END RESULTS.*

BY JAMES MORLEY HITZROT, M.D.,
OF NEW YORK,
Associate Surgeon, New York Hospital; Assistant Surgeon, Bellevue Hospital.

THE presentation of this subject to the society has been prompted by the diverse opinions now existing regarding the question of open operation or conservative reduction in the treatment of recent simple fracture.

The whole question received its present impetus from the presentation of the subject of open operation in recent simple fracture by Mr. Lane.[1] While admiring Mr. Lane's able presentation of the purely operative side of the treatment of fractures, as well as his eminently successful results, it did not seem to the writer, from his experience, that one could safely subscribe to all of Mr. Lane's conclusions—and especially to that one which states that, "accurate or anything approaching accurate apposition of the displaced fragments in a fracture was obtained in only very rare cases by the various non-operative methods."

Bloodgood[2] quotes Lane as stating that the end results of the non-operative treatment for fractures are uniformly bad except in the hands of experts, and gives as his (Bloodgood's) opinion that more cases will be submitted to operation when publicity has forced better methods of treatment for fractures upon the profession.

Stimson[3] takes the opposite view from that elaborated by Lane, and sounds a warning of the dangers of the open method of treatment. Stimson bases his opinion upon the success obtained by him with non-operative methods.

Freeman,[4] in a discussion of the subject, takes what might be called a middle course between the above divergent views, and states, that by operating in well-selected cases better results can be obtained. He goes even further and gives a list of fractures with what he would consider the

* Read before the New York Surgical Society, Dec. 13, 1911.

method of election in their treatment. The clavicle and transverse fractures of the long bones should be treated by conservative methods; avulsion of the tuberosities of the tibia, humerus, and os calcis; fractures of the surgical neck of the humerus with dislocation or rotation of the head of that bone; fractures of the humerus just above the elbow-joint; and spiral fractures of the long bones should be treated by open operation. Fractures of the olecranon and patella, he considers, occupy an intermediate position—some cases without separation being best treated by conservative measures while operation is indicated in all cases with separation of the fragments. At the elbow-joint every fracture should be operated upon when satisfactory replacement of the fragments, as shown by the X-ray, cannot be accomplished otherwise.

Quoting Freeman further: "The success of operative intervention depends much upon the accessibility of the fracture, the danger varying directly with the amount of manipulation required; that faulty alignment and overlapping of the fragments do not mean disturbance of function, and, that in carefully selected cases it must not be forgotten there are two important drawbacks to operative intervention, namely, infection and delayed union."

If one can state these divergent views clearly Lane advocates nothing but operative treatment for simple fractures. Certainly one obtains such a belief from his papers.

Stimson favors the non-operative replacement of displaced fragments in all cases where this is possible, and limits operative interference to a very carefully selected class of cases in which operation offers a more suitable result, weighing carefully all the dangers coincident to that operation. In his book "Fractures and Dislocations" Stimson,[5] admits the propriety of operative interference when the fragment has been drawn into the muscle, and when the displacement in articular fractures, if uncorrected, may seriously interfere with the usefulness of the joint. As little relief is to be expected by a late operation, the operative treatment must be carried out while the injury is still recent, *i.e.*, within the first 24 hours, with this reservation, "but I am convinced it should be resorted

to only after thorough study of the conditions and careful weighing of the probabilities."

In the reservation of Stimson and in the selection of Freeman, we find what may be considered the solution of some of the phases of this question. Extreme views pro or con rarely lead to a clear understanding of any subject, and such statements that only operative interference can produce the desired result cannot safely be subscribed to, nor can Bloodgood's belief that more cases will be submitted to operation when publicity has forced better methods of treatment of fractures upon the profession be allowed to pass unchallenged. Credit should be given these gentlemen for attracting the attention of the profession to the necessity of better and more careful treatment of fractures. That fractures should be handled by experienced individuals to procure the most favorable result should be axiomatic. Much of the present disability occurring in uncomplicated fractures is due to neglect or to a lack of experience upon the part of the medical attendant. No method, however perfect, will succeed if improperly carried out in any of its details, and the too ready assumption of ability to treat any and all fractures on the part of the inexperienced lays the profession as a whole open to sharp criticism emanating from Mr. Lane.

The crux of the entire question seems to be in what is to be most desired in the treatment of fractures, accurate anatomical reposition by open methods or approximate alignment as shown by the X-ray, with restoration of function to a degree sufficient for all practical purposes. If proper exact reposition anatomically is the only means toward the restoration of the above degree of function, and replacement can be obtained only by open operation, no surgeon of experience should hesitate to operate. But if satisfactory restoration of function, even in the face of what is not exact anatomical replacement, is possible by simpler, less dangerous methods, open operation should not be the method of election.

Deformity and disability are not always the result of improper replacement. Fractures of the lower end of the radius (Colles) may be completely replaced, yet crushing of the

spongy lower end may so shorten the radius that the level of the two styloids is distinctly altered, the lower end of the ulna becomes prominent, the wrist-joint wider, and some radial deviation of the hand self-evident; yet function may be perfect except for very slight limitation of ulnar deflection. The same may be said of fractures involving the upper end of the humerus. Anatomical replacement, judged by radiographs, may seem perfect, yet, due to impaction, some shortening is inevitable and complete abduction may be impossible and external rotation distinctly interfered with. The same traumatism may also set up coincident joint changes, which do not appear until later or after the healing of the fracture and the return of function has been quite satisfactory to the individual as well as his surgical attendant.

The following case may illustrate this condition more clearly:

The patient, J. B., a man forty-three years old, was admitted to Bellevue Hospital, Dr. Gwyer's service, 1907, with a history of having fractured his right shoulder three years previously by a fall against the curb. The arm was set at the Presbyterian Hospital and put up in plaster away from the body. At the end of three months his shoulder was moving nicely and he was able to return to his work as a painter. The mobility of the joint steadily improved with use and he had no trouble except stiffness in the morning. About five months after the injury, that is eight weeks after recovery, he noticed that his right shoulder-joint was slightly swollen, and about the same time he had some pain, especially when he used the arm overhead. This pain has slowly but steadily increased up to the present, and function has become more limited, so that the arm is at present nearly useless. There are no other phenomena of any importance and no history of other joint inflammations, etc., of any bearing on the case, and he had no previous injury or disease of the right shoulder except the fracture. On examination the right shoulder was found swollen to twice the size of the opposite shoulder. The swelling was symmetrical, there was no skin inflammation, and no tenderness on palpation. Pain on active motion, passive motion was very painful if carried to any degree, no crepitation, joint loose, capsule tense and fluctuant. The X-ray showed no bony change, a

perfect bone alignment, but a diffuse haziness about the head of the bone in the region of the distended capsule. On anterior incision, a villous arthritis with a clear straw-colored fluid was present in the joint. As much synovial membrane as was hypertrophied was excised. The bones and cartilage were normal. The pericapsular tissues were loosely closed, the wound drained subcutaneously from the lower angle and bound in a bulky dressing to the chest. The post-operative course was uneventful except for a thick, viscid synovial discharge for two weeks. The end result two years after operation was freedom from pain but a very restricted movement in all directions at the shoulder-joint in spite of massage, baking, passive motion by the Zander method, etc.

Personally the writer does not know what the gentleman could have done who obtained what the patient considered a good result nor is it clear how open operation could have in any way prevented the joint change.

Age must always play an important part in the result of any treatment for fracture. Extension fractures of the humerus (supracondylar) in children never give any disability and rarely any deformity, while the same lesions in the elderly result in marked disability even with perfect reduction without deformity.

Obviously it has not been possible to trace every case of any given type, as many have disappeared, but those which have been found are sufficient to give a fair idea of what the result in certain given types has been. Purposely many types of fractures have been omitted, such as fractures of the skull, of the bones of the face, of the pelvis, and fracture of the metacarpus and metatarsus and their phalanges, Colles's fracture, and cases of multiple injuries where the fracture or fractures had, in the original treatment, to be treated by the most expedient although often inefficient methods because of the patient's general condition—for example, crushing injuries of the chest and pelvis with fractures of both femora, etc.

The treatment has been the same in all cases of similar type, and the details will be given under the discussion of the type. One fact has become quite evident as the cases have been analyzed, viz., that early reduction before infiltration has

occurred has given the best results. When the fracture has come under observation after the infiltration has occurred, it has often been impossible to bring about satisfactory reduction even under anæsthesia. In such cases extension by a sufficiently heavy weight, with constant supervision, was tried until replacement became easy or was obviously impossible by such means. That the period of time for such extension should not exceed one week from its inception became more and more evident, for displacements in over-riding, which could not be pulled down in that time, have not, in the writer's experience, been benefited by longer traction (this of course does not imply that traction should cease or did cease when the result was satisfactorily accomplished). When, at the end of a week, traction did not seem to be likely to accomplish the desired result, the patient was anæsthetized and reduction attempted under ether, and fixation apparatus applied while suitable traction was maintained. Very little benefit resulted from this procedure except in a few cases. The results of these procedures were controlled by measurements and suitable X-ray pictures, and when the latter did not show satisfactory results operation was carried out, after all the factors, such as age, cardiovascular, renal, and other intercurrent conditions, with the accessibility of the fracture, were given due consideration. In operating no foreign material was used when avoidable, chromicized gut was used wherever available, and Lane's plates only where other methods did not seem likely to avail.

Of the many types of extension those advocated by Bardenheuer,[6] the Hodgens splint and vertical suspension, were the most used.

Reduction under ether is always essential when there is no contraindication to that anæsthetic. In minor cases gas or gas and oxygen is preferable. In certain types, of which fractures of the shaft of the femur form the chief group, reduction under an anæsthetic often fails because of the inability to overcome the muscular pull, and in these the various forms of traction apparatus find their chief usefulness.

The author has used the following expedient for reduc-

tion under ether: Adhesive plaster is applied to the lower leg up to and above the knee as in Buck's extension. To the lower end of this is fastened a strong loop (three thicknesses of muslin), and this is put over the shoulders of an assistant, who, bracing his feet, leans backward, using the weight of his body for traction. A sheet folded lengthwise is passed under the patient and over the perineum and up over the body in the long axis of the body, and counter-traction made by the pull of a second assistant, who, holding both ends or passing the sheet around his body, braces his feet and leans back, using the weight of his body for counter-traction. This assures a steady pull without fatigue or the necessity of obtaining a fresh grip. (Dr. F. W. Murray, private communication, tells me that the above method of traction is one employed by Willelms of Ghent and was shown by Willelms at the recent International Surgical Congress at Brussels. The writer has been unable to find the published details, but claims no priority for a method which has doubtless been used by others.)

Of the many forms of retention apparatus, moulded plaster splints, made according to the method given by Stimson (*loc. cit.*) have proven the most satisfactory and have been used by the writer to the exclusion of all other forms of splint because of their strength, lightness, ease of removal and replacement.

Another too often neglected part of the proper treatment of fractures is the so-called after-treatment. Massage should be begun as soon as the callus is solid enough to prevent displacement and as soon as pain on handling has disappeared. Baking should be begun as early as the beginning of the second week. The time for removing the fixation apparatus is one of the niceties in the after-treatment, and no time can be specifically stated. In general, the earlier active and passive motion is allowed, within the limits of pain, the better the result. Obviously no weight should be borne by a bone or bones which are not yet solid without additional external support.

Hydrotherapy and electricity for the preservation of muscle tone and activity should never be neglected.

An X-ray picture is, in the large majority of cases, in no

wise essential for diagnosis of fracture, but is of invaluable aid as an adjunct in determining the result of a given method of reduction and retention, and should never be omitted. Since early reduction before infiltration of the soft parts has occurred has given the more favorable results, any lengthy delay for an X-ray picture should be avoided, reduction done, and the ray then requisitioned to control the result and this later act should be carried out without any delay. Too often such control pictures, measurements, etc., are left until only operation remains as a means of approximation of the fragments, although the picture for diagnosis is never overlooked.

Where operation is necessary, so many successful expedients have been proposed that the selection of any given type of fixation must, of necessity, be governed by the fracture in question. The writer uses no fixation apparatus when the two fragments can be held in alignment without it (manipulation is done with the bones in view). If possible only strong chromicized catgut is used, and where it seems likely to fail the method advised by Lane seems the most expedient. Intramedullary splinting and fixation by screws with outside plates are doubtless very successful in the hands of the originators, but the writer has found the above quite sufficient to meet the various conditions which have come under his care.

That the cases here have been selected may be criticized, but, admitting the criticism, the cases were chosen not because of their types, nor because the result may or may not have been favorable, but simply because the individuals in question had a more fixed and more easily found domicile and were not the birds of passage with the municipal lodging house or Mill's Hotel addresses. Any one who has tried to trace the latter class of individuals, especially in New York City, will appreciate the reason for such selection. Some cases by virtue of suits at law to obtain recompense for their injuries from employers, etc., have kept the writer from losing track of them.

CLAVICLE.—Twenty-seven cases of fractured clavicle were traced. Nine cases were in children 2, 3 (3 cases), 4, 5 (2 cases),

6, 7 years of age; 4 cases were in women (17 to 27 years of age); 14 cases in men (16 to 37 years of age). Type of fracture: In 4 cases the fracture was transverse, in the remaining 23 it was oblique. Seat of involvement: The middle third of the clavicle in all cases. Type of deformity: Upward and forward displacement of the outer end of the inner fragment, downward and inward displacement of the inner end of the outer fragment with over-riding of the fractured ends. Method of treatment: reduction was accomplished by placing the patient prone on the back with a sand bag between the shoulder-blades and a sand bag under the sacrum. In this position the ordinary Sayre dressing was applied and so adjusted after patient assumed the erect position that it kept the fragments as nearly as possible in the position obtained with the patient recumbent as described. After appropriate axillary and skin padding, a Velpeau bandage was applied and the above dressing kept on the patient for three weeks. Massage was then begun and the arm carried in a sling for one week longer.

Result: In all the cases there was slight deformity at the site of the fracture (*i.e.*, thickening with a visible angulation as compared with the opposite side and shortening of the clavicle of from 0.3 cm. to 0.5 cm. The shortening was less marked in the children and most marked in the men, and the same statement applies to the visible and palpable deformity. There was no disturbance of function in the arm movements of any of the patients. One woman suffered from rheumatism in the shoulder when the weather threatened rain, but localized the pain over the shoulder in general rather than over the site of the injury in particular.

HUMERUS.—*Fractures of the Surgical Neck* (141 Cases).—Sixteen cases of old fractures in this region sought relief from disability, but as the treatment was not begun at a time likely to give any reliable result, they are not included in the above figures. Seven other cases which died of intercurrent disease within three months after the injury and three cases reported by relatives as perfectly well with useful arms have likewise been excluded.

Of these 141 cases for analysis 2 were in children (7 to 9 years of age); 38 were in women (49 to 67 years of age); and 101 in men (45 to 79 years of age). Sixty-nine cases were fractures through the tuberosities, 70 were below the trochanter, 2 began well below the trochanter and ran upward through the greater tuberosity, separating it as a separate fragment from the

head and the upper end of the shaft. Of the 141 cases, 65 had displacement of the upper end of the lower fragment into the axilla, 67 were more or less impacted with penetration of the upper end of the lower fragment into the upper with crushing of the upper fragment (of these 63 had little gross displacement); 7 were clear-cut transverse fractures with varying amounts of internal displacement of the lower fragment, from that completely under the coracoid to practically none whatsoever, and the two, mentioned above, were irregular in type.

Type of deformity: Those cases with marked axillary displacement showed an obtuse angulation in the limb about halfway between the acromion and deltoid insertion. The impacted cases and other types had swelling about the deltoid region and shoulder.

Treatment: With the forearm flexed and held in a sling a modified Stromeyer cushion was placed in the axilla for abduction, and adhesive plaster strips were applied from the level of the deltoid insertion to the elbow, with the ends extending below the level of the elbow for about six inches. To these ends a weight of from five to ten pounds was attached and allowed to hang for one hour. If reduction was then satisfactory, moulded plaster splints were applied. (The posterior splint should begin at the base of the neck and pass down the arm to the wrist on its posterior aspect, leaving the latter joint free. The anterior splint should begin at the vertebral column about the level of the superior angle of the posterior border of the scapula, pass forward across the shoulder cap of the posterior splint and down the arm to the wrist.) The weight and cushion should be kept in place during the application of the splints, and the width of the cushion should be sufficient to bring the bone in proper alignment. An X-ray picture was then taken. In cases where reduction was not satisfactorily accomplished in that time, the arm was bound to the chest and traction continued over night and the splints applied on the following day. One case, E. D., age nine, was operated upon. The fracture was eight days old and reduction under anæsthesia impossible. Through an anterior incision the seat of fracture was exposed and the line of fracture found to be through the shaft just below the epiphysis. The upper end of the lower fragment was mobilized and jammed into the cancellous lower end of the upper fragment, where it remained without any tendency to become displaced. Wound closed without drainage (splints

as above, X-ray photographs, Figs. 2 and 3, from Dr. Hartley's service, New York Hospital, 1908).

After-treatment: Massage was begun at the end of ten days and carried on every second day. At first the splints were kept on for five weeks, but as the writer gained confidence it was possible to remove the splints at the end of the third week. Passive motion was begun as soon as the swelling subsided, and active motion when the splints were removed, and the free use of the arm allowed at the end of the fifth week. Electricity (galvanic and faradic) begun at the end of the fourth week in the last 50 cases for the nutrition of the deltoid. (*Vide* the results.)

Results: The two children, one operative and one non-operative (Fig. 1), had perfect results with no limitation of motion. Both showed one-sixteenth of an inch shortening (measured from the acromion to the head of radius).

In the remaining 139 cases hyperabduction of 5 per cent. was lost in all except two cases. In one of these cases the arm could only be abducted about ten degrees beyond the horizontal (woman with an impacted fracture with no displacement); in the second case (also an impacted fracture with no displacement), hyperabduction was possible to half the distance of that on the normal side. In testing the degree of hyperabduction, the vertebral border of the scapula was marked with the arms at the side and, during the act of hyperabduction, the scapular border moved one-eighth of an inch further from the midline on the affected side than on the normal side, showing that the extra movement beyond a certain point was accomplished by an increase in the movements of the scapula.

External rotation of from 5 to 10 per cent. less than on the normal side was present in all cases.

In both external rotation and hyperabduction, the relative loss in motion was much less in those 50 cases in which the splints were removed earlier, active motion begun in the fourth week, and electrical stimulation applied to the muscles.

Pain was present in twenty-two cases, especially during barometric changes; 67 cases had some stiffness in the shoulder on arising, which disappeared when the arm was used.

Case I.—*Fracture at the Neck with Dislocation of the Head* (4 Cases).—John A., age forty-two, Bellevue Hospital, Dr. Gwyer's service, 1907. Fracture of the surgical neck with subcoracoid dislocation of the head of the right humerus (X-ray

FIG. 1.

Result in fracture of the surgical neck of the humerus.

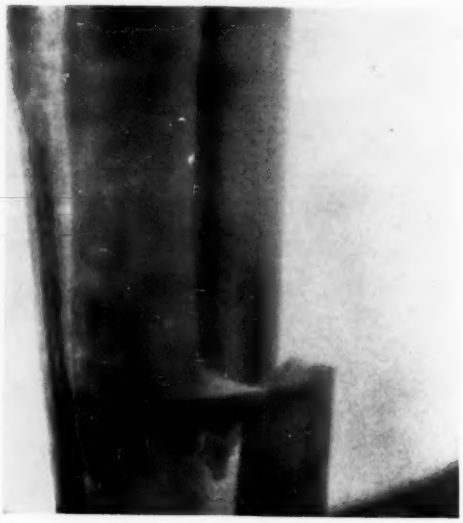
FIG 2.

Fracture of the surgical neck of the humerus, before operation. (See Fig. 3.)

FIG. 3.

Fracture of the surgical neck of the humerus, after operation. (See Fig. 2.)

FIG. 4.



Fragment interfering with reduction; operation indicated. (From the service of Dr. F. W. Murray.)

FIG. 5.

Diacondylar fracture of the lower end of the humerus in an adult, before reduction.

FIG. 6.

Diacondylar fracture of the lower end of the humerus in an adult, after reduction. (See Fig. 5.)

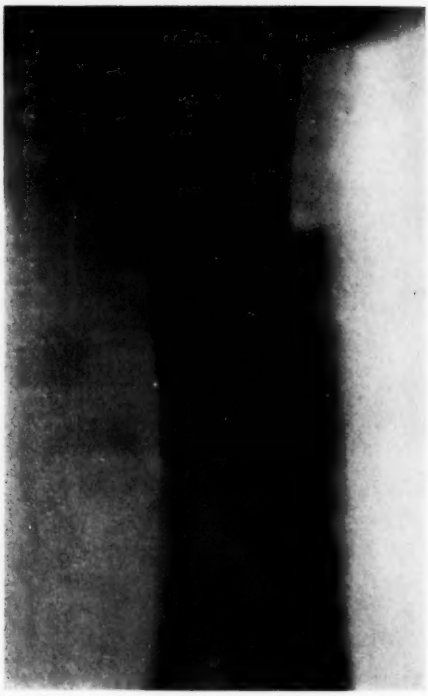
FIG. 7.

Position of fragments after efforts at reduction of a fracture of the bones of the forearm in their upper third.

FIG. 8.

Result obtained by traction in a subtrochanteric fracture of the femur.

FIG. 9.



Result obtained by method described in text for reduction of a fracture of the femur. (Case of John G.)

FIG. 10.

Result of reduction in a fracture of the leg

FIG. 11.

Result of reduction in a fracture of the leg.

FIGS. 12 and 13.

Result of reduction in a spiral fracture of the tibia and an oblique fracture of the fibula in a child.

diagnosis). Operation refused. Patient was a Christian Scientist. Sixteen months after the injury shoulder was stiff, with no movement in any direction. There was marked weakness of all the muscles of the hand and forearm, with atrophy of the entire arm. The patient was satisfied with the result.

CASE II.—Harriet DeC., age forty, Bellevue Hospital, Dr. Woolsey's service, 1910. *Fracture of the anatomical neck of the left humerus with dislocation of the head into the axilla* (X-ray diagnosis). Removal of the head through anterior incision nine days after injury. Result: Limitation of motion at the shoulder-joint. Abduction to 75 degrees. Very little external rotation. The patient could just get her hand to the top of the occiput. There was no pain, the deltoid was atrophied, but there was no skin anæsthesia over the deltoid (three months after operation).

CASE III.—D. C. L., age forty-nine, Bellevue Hospital, Dr. Rogers's service, June, 1911. *Fracture of the anatomical neck of the humerus (left) with subcoracoid dislocation of the head. Splintering of the shaft of the humerus on its inner side.* Operation 16 days after injury. Anterior incision, attempt to replace head failed, head excised, moulded splints with the arm in abduction. Massage, passive movements, etc., at the end of the third week. Result: Six months after operation abduction to beyond a right angle, very slight external rotation. The patient is able to reach the posterior collar button with ease.

CASE IV.—Mrs. B., age sixty-three (reported by Dr. A. B. Johnson, ANNALS OF SURGERY, vol. li, 1910, p. 267). *Excision of the head for fracture of the anatomical neck of the left humerus with displacement of the head into the axilla.* Result: Nine months after injury, abduction to a right angle; very little external rotation; some pain after use of the shoulder.

Fracture of the Shaft of the Humerus.—Seventeen cases, all men ranging in age from 17 to 47 years.

Type of fracture: 10 cases were transverse or nearly so; 6 cases were oblique (with comminution in 1 case; 1 case was a spiral fracture.

Location: All were situated between the deltoid insertion and the supracondylar ridge, and gave no characteristic deformity other than over-riding and shortening of from one-half to two inches.

Treatment: Modified Stromeyer pad in axilla, extension by adhesive plaster and weight, and moulded plaster splints (see

fractures of the surgical neck for detail). Massage was begun on the fourteenth day and the splints removed at the end of the fifth or sixth week, depending upon the solidity of the callus. In one case solid union did not take place until the tenth week. One case fell and refractured the arm through the callus in the tenth week, and the repair of this second fracture was not complete for fourteen weeks.

Results: In the ten transverse fractures function was perfect and no shortening was present. One case had slight angular deformity at the line of fracture due to insufficient abduction. The spiral fracture and two of the oblique cases showed one-eighth of an inch shortening. The other four oblique cases showed no shortening, a perfect alignment of the arm. In all these cases function was perfect. In the case in which refracture occurred, atrophy of the involved arm was quite marked. The difference in circumference, three inches above the olecranon, was two inches less on the affected side. This atrophy may undoubtedly be explained by the long period of disuse (19 weeks).

Fractures of the Lower End of the Humerus.—One hundred and six cases were in children from 1 to 10 years of age. Of these 52 involved the external condyle; 54 cases were supracondylar fractures; 34 cases were in adults from 20 to 74 years of age.

Fifty-one cases of fracture of the external condyle in children were all treated by hyperflexion with a moulded posterior splint or adhesive plaster and bandage for two weeks, when all fixation apparatus was removed and massage begun. One case (Mamie C., Bellevue Hospital, Dr. Woolsey's service, 1908) had rotation of the fractured fragment which could not be corrected and the broken fragment was removed by open operation. All had perfect return of function with no appreciable deformity. The 54 cases of supracondylar fracture in children were reduced under anæsthesia, and moulded plaster splints applied with the arm flexed to a right angle or slightly beyond it. To prevent the gun-stock deformity the writer has found a moulded posterior splint from the shoulder to the wrist with a U-shaped splint about the elbow, with that arm of the U over the inner side of the forearm placed a little more upward than the posterior limb of the splint, to be the most satisfactory.

Two of the cases had musculospiral paralysis and were operated upon, one four and one five weeks after the injury. In one of the cases, the musculospiral nerve was torn completely

apart just at the level of the fracture (Johnny C., 1910, House of Relief, Dr. Hartley's service. The ordinary end-to-end anastomosis was done, and nerve function as evidenced by the return of extension became complete in twenty weeks. In the second case (William S., New York Hospital, 1908, Dr. Hartley's service), the nerve was found flattened out over the line of the fracture, but its continuity was not severed. The nerve was freed from the scar tissue surrounding it. Function did not become marked until seven months had passed, and nine months after the injury was not as satisfactory as that in the first mentioned case.

Function at the elbow-joint was perfect in all cases. Fifty cases had no perceptible deformity, and arm tracings showed the same carrying angle for the two arms. One case had almost a straight arm in the extended position, and three cases had a perceptible change in the tracings with a diminution of the carrying angle on the affected side.

Of the 34 adult cases, 12 involved the external condyle; 11 were uncomplicated. In one there was a fracture of the head of the radius without displacement of the fragment. All were treated by flexion with a posterior plaster splint, but the degree of hyperflexion possible in children could not be obtained here. There was no deformity in any of the cases. Function was excellent but not perfect, extension was less complete by about five degrees and flexion by about ten degrees, the flexion being most limited in that case with concurrent injury to the head of the radius.

Six cases were fractures of the internal condyle treated by flexion and plaster splints after reduction under ether. The function was excellent in all cases, perfect in one. Extension and flexion were limited by from five to ten degrees in five of the cases. Widening of the joint with thickening of the lower end of the humerus was present in all cases.

Four were T- or Y-shaped fractures. Reduction was done under an anæsthetic and moulded splints of the type described in the treatment of fractures of the surgical neck were applied with the forearm flexed to, or slightly beyond, a right angle. Reduction was not satisfactory on the first attempt in any of the cases and had to be tried four times in one of the cases before the fragments were brought into suitable apposition. Deformity was present in all cases, *i.e.*, widening of the elbow-joint with

distinct anteroposterior thickening of the humerus and one-eighth of an inch shortening. Function: Flexion 20 degrees beyond a right angle and extension to 150 degrees in all cases. Pronation and supination of the forearm were perfect. One case had some stiffness in the joint in the morning, which disappeared as the arm was used. All do hard manual labor but find the injured arm sufficiently useful for all purposes.

In all of the above types baking and massage were begun on the tenth to the fourteenth day and active and passive motion, within the limits of pain, at the end of the third week, and all fixation apparatus was removed at the end of the fourth week. Full use of the arm was permitted in the tenth week.

One case (Henry W., Figs. 5 and 6, service of Dr. F. W. Murray, House of Relief, May, 1911) was a supracondylar (diacondylar) fracture in an old man seventy-nine years of age, and resembled that lesion as it occurs in children except that the articular fragment was displaced forward and inward. Under morphine ¼ gr. and gas and oxygen anæsthesia, reduction was done and a posterior moulded splint from the shoulder to the wrist was applied, with the arm flexed to a right angle. Flexion beyond this point caused the lower fragment to slip slightly backward and inward. Massage and baking were begun at the end of the first week, passive motion on the sixteenth day, and all fixation apparatus removed on the twenty-fifth day. No deformity was present, but after 6 months of baking and massage flexion was limited to about a right angle (occasionally the patient could bring the forearm beyond that point with the other arm). Extension was limited to 130 degrees and supination was just half that of the normal arm. The patient had "rheumatism" in the joint and very marked stiffness which took several hours to disappear. He had arthritis deformans in both hands, wrists, feet, and a very high degree of arteriosclerosis. The degree of functional disability, the pain and stiffness in this case, are worthy of comparison with the result of the same lesion in children, yet the X-ray showed perfect anatomical reposition of the fracture!

Eleven cases may be classified as extension fractures of the lower end of the humeral shaft. The line of fracture began just about the level of the epicondyles and ran upward and backward obliquely to varying levels. All were in men and all presented the characteristic deformity of this type.

Seven were reduced under anæsthetic, four by traction by adhesive plaster and weight and abduction (Stromeyer pad; see method for surgical neck and shaft). After reduction the same moulded plaster splints were applied as in fracture of the surgical neck of the humerus with flexion of the forearm to or just a trifle beyond a right angle. In none of the cases was absolutely perfect end-to-end alignment obtained, the lower end of the upper fragment over-riding and projecting beyond the line of fracture of the lower fragment to a very slight degree. In all cases massage was begun at the end of the second week. Solidity occurred in all but one case by the end of the sixth week. The latter became solid in the ninth week. There was no visible deformity in any of the cases, one-sixteenth to one-quarter of an inch shortening (the majority being one-eighth of an inch short). Function was perfect in every case.

RADIUS.—There were 29 cases of fracture of the head and neck of the radius. Of these 19 involved the head and 10 the neck.

In 15 cases of *fracture of the head* there was but little displacement of the fragments. In four cases the fragments were displaced anteriorly.

The disability was rather characteristic in all types. The arm was held in flexion midway between pronation and supination and both the latter movements were impossible. Pain was markedly increased by abducting the arm and pressing over the head of the radius, and especially so, if pronation and supination were attempted in the above position with the above pressure.

Treatment: In the fifteen cases without displacement the arm was supported by a posterior splint, baking begun on or before the third day, and massage before the second baking, *i.e.*, on the fifth day. Movements in flexion and extension were begun as soon as the swelling subsided, usually about the tenth day. Pronation and supination were begun about the fifteenth day. Result: Flexion and extension were complete in all the cases. In two cases (chipping off of the radial side of the head) pronation and supination were so slightly altered as to be classed as perfect. In eleven cases pronation and supination were half of that on the normal side. In two of the same type as the first two mentioned cases, but with the line of fracture beginning well to the ulnar side of the articular surface of the head and extending outward through the head, supination was one-quarter and

pronation one-half normal. Both the latter cases have some pain during pronation and supination.

In the four cases with displacement of the fragments the X-ray was necessary for diagnosis of the displacement. In two the head was broken into three fragments, two of which were displaced anteriorly while one fragment remained in position. In this type the entire head was removed by cutting through the neck about one-half inch below the articular surface of the head and removing the head.

In the remaining two cases the head was broken in one place only and the fragment which was radially placed was displaced outward and forward, and in this type the fragment only was removed.

The after-treatment was similar in other respects to that pursued in the fractures without displacement.

Result: The resulting motion was better in those cases in which the head was removed and better in that case in which the most bone was removed (*i.e.*, the neck cut through at the lowest possible level). In the last mentioned case supination was present to seven-eighths the normal and pronation was complete. In the other case of complete removal, supination was two-thirds normal and pronation seven-eighths normal.

In the two cases of partial removal of the head, supination was one-half normal, pronation two-thirds normal, and pain was present during either movement in one of the cases for nearly a year.

The ten cases of fracture of the neck of the radius were all transverse in type and involved that portion of the shaft about one-half inch below the head. The X-ray was used to confirm the location of the fracture, and in none of the cases was there any marked displacement.

Treatment: With the arm in the mid-position between pronation and supination a U-shaped plaster splint (see fractures of both bones of forearm for details) was applied and left on for from 3 to 5 weeks. Massage was begun on the tenth day and passive motion and rotation at the end of the third week.

Result: Pronation was complete in two cases and in these two supination was also nearly complete. In the other eight cases, pronation was two-thirds normal and supination five-eighths normal.

ULNA.—*Olecranon*, 47 cases, all in males ranging in age from

18 to 49. The line of fracture was transverse in 23 cases and oblique in 24 cases.

In 26 cases there was no displacement of the fragment and no deformity other than the swelling. Where separation between the fragments existed, distinct angulation at the line of fracture or definite depression between the fragments gave a fairly characteristic deformity. In both types the X-ray was used to determine the method of treatment, unless such gross displacement was present as to render that procedure superfluous.

Treatment: 26 cases were treated in the extended position with a posterior moulded splint; 21 cases with more or less displacement were operated upon at the New York Hospital by members of the attending staff. Chromic catgut was used to approximate the fragments by drilling the bone in 11 cases, by suture of the torn fascial expansion and periosteum in 10 cases. Massage was begun at the end of the second week in both varieties, and slight movement in flexion in the third week, and full motion permitted in from 9 to 10 weeks. Baking was used in 12 cases.

Results: Function was perfect in 40 cases. In 6 cases, 4 operative and 2 non-operative, there was a perceptible loss in flexion and in one of the non-operative cases this loss of flexion was 10 degrees. Two cases which were operated upon show separation of the fragments, one four months and the other six years after operation, *i.e.*, fibrous union. There is no movement between the fragments, and function is perfect in both cases. In one case the bone was drilled, in the other suture of the fascia alone was done.

Fractures of the Shaft of the Radius and Ulna (91 Cases).—Sixty-one cases were in children from 1 to 15 years of age and 30 were in adults from 17 to 47 years of age. Of the cases in children, 21 were subperiosteal fractures of both bones, 12 were subperiosteal in the ulna with complete fracture of the radius, and 28 were complete fractures of both bones.

In the 58 cases of complete fracture of both bones (28 children and 30 adults), the line of fracture was transverse in 50 cases and oblique in 8.

The middle third of the bones was the region most frequently involved, and the radius was fractured at a slightly higher level than the ulna in all but four of the cases.

Deformity: The usual angulation, which was most marked in the complete fractures of both bones.

Treatment: Ether anæsthesia, correction of the angulation in the subperiosteal type; in the other types approximation of the ulnar fragments, then traction in ulnar abduction. This traction should be made by two assistants so that the surgeon can manipulate the radial fragments into proper alignment. When the necessary approximation is obtained the arm is straightened, the traction being maintained, and the U-shaped moulded plaster splint[7] applied, with the arm in the mid-position. The fingers must always be left free.

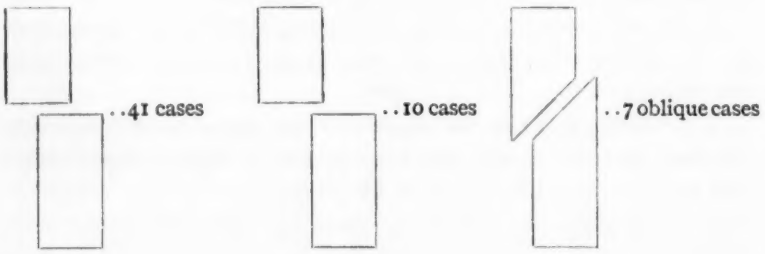
In the transverse fractures one attempt to bring the radius in approximate apposition sufficed in all but one case. In the oblique variety four separate attempts were needed in two cases. The one unsuccessful reduction in the transverse type was ten days old when first observed and could not be reduced. Non-union at the end of eight weeks forced the patient to consent to open operation. The ends of both bones were freshened, sutured with chromic gut, and the U splint applied.

Massage was begun in the second week and the splints were removed as soon as the bones were solid (4½ to 9 weeks, average 6 weeks). In the operative case, solid union did not occur until the fourteenth week.

Results: In the 33 subperiosteal fractures function was perfect in all cases; 7 cases showed slight bowing of the forearm, as determined by outline drawings with the arm in the mid-position between extension and flexion.

In the cases of complete fracture, function was perfect in all but two cases. In these supination was five-eighths normal and pronation almost complete. Complete perfect end-to-end apposition of the radial fragments was not obtained in any of the cases.

The apposition was as follows (X-ray tracings, schematic):



In the seven oblique cases, there was shortening of the affected forearm of one-sixteenth to one-eighth of an inch and slight bowing on the radial side of the arm. Union in these cases took from two to four weeks longer to become solid than in the transverse type, but occurred in all seven. The function was good in the one operative case, supination was six-eighths normal and pronation almost complete. The arm was one-eighth inch short.

THE CARPAL SCAPHOID.—Fourteen cases were followed; in 7 there was no displacement of the fragments; in 3 the proximal fragment was displaced; and in 4 there was coincident dislocation of the semilunar with displacement of the proximal scaphoid fragment.

The 7 uncomplicated cases were treated by a moulded anterior splint with the hand in slight radial deflection and extension, and the fingers left free. Baking was begun in the first week, massage in the second week, and full movement in the sixth week. Hyperextension was limited in all cases, flexion in one only. In the latter case pain on motion was present during heavy lifting and after long use.

In the three cases with displacement of the proximal fragment, it was removed through a dorsal incision and treated as in the above type. Extension was limited to two-thirds normal and flexion to seven-eighths normal. Ulnar deflection was less on the affected side.

In the four cases with dislocation of the semilunar and displacement of the proximal fragment of the scaphoid, the semilunar and the displaced scaphoid fragment were removed in three cases. In the fourth case the scaphoid fragment was removed and the semilunar replaced. At least it seemed to be reduced at the operation, but the radiograph showed the semilunar still displaced, although not to the same extent as before operation. The result at the end of nine weeks was a stiff wrist. A second operation was refused, and at the end of six months the wrist was still stiff and the patient disappeared. In the first three mentioned cases the result was fair in two. There was some radial deviation of the wrist, the lower end of the ulna was more prominent, flexion and extension were one-half normal. There was some stiffness in the morning and, as explained by one patient, a sense of insecurity after the wrist was used for a time and when heavy lifting was done. No pain existed. One case, the most satisfactory, has already been shown to the society (ANNALS OF

SURG., 1910, vol. lii, p. 261) and in that case there was practically no limitation of motion, and pain only in dorsal extension when lifting unusually heavy weights.

THE FEMUR.—In selecting the cases for observation, fractures of the head, of the neck, and fractures of the neck involving the trochanters have been excluded as those types have been investigated and the end results reported by Whitman,[8] Walker,[9] Forbes,[10] Flint,[11] and others.

In choosing the cases for observation, the writer has attempted to select cases with a sufficient variety of bone lesions to show the value of any given type of treatment as determined from the end result.

Fifty-three cases have been followed; 2 involved the shaft below the trochanters, 40 involved the shaft, chiefly in the middle third, and 11 were fractures which involved the condyles or the shaft immediately above the condyles.

Two cases of *fracture immediately below the trochanters* (Stafford, New York Hospital, Levinthal, Bellevue Hospital), men, past forty. One was a transverse fracture and the other an oblique fracture about six inches below the posterior lip of the greater trochanter. In both cases the upper fragment was flexed and abducted and there was two inches shortening (measured from the tip of the greater trochanter to the internal malleolus). Both were treated by suspension, traction, and abduction in the Hodgins splint for five weeks, and then by a plaster spica for five weeks longer, at which time union was sufficiently solid to permit the wearing of a long side splint of moulded plaster. Massage was practised thrice weekly after the tenth week and the knee and hip moved during the massage. Weight-bearing without support was permitted in the fifteenth week and full use of the leg as soon as the patient gained confidence enough to walk without support. The time element for this must naturally vary widely. It did in the above two cases. In the oblique case the patient walked alone and unsupported at the end of the seventeenth week. In the transverse case, although muscular power, bony solidity, and freedom of motion in the hip, knee, and ankle were present, the man did not gain enough confidence to walk alone for over two months. He did walk for long distances holding on to the arm of an attendant.

Result at the end of six months: Perfect function in both cases with ¼ inch shortening. The case with the transverse fracture

walked with a slight limp, which disappeared when the heel of his shoe was raised ⅛ of an inch.

Fractures of the Middle Third of the Femur (40 Cases).—In speaking of this region it should be described as the middle two-fourths, as the line of fracture in some of the cases extended either above or below the actual mid-third, although the majority involved that region.

Twenty cases in children from 1 to 8 years of age have been followed. Of these one case, infant 13 months old, had an incomplete fracture of the middle third, one case had a spiral fracture beginning in the lower third and extending upward, the remaining cases were transverse.

The deformity in all except the incomplete fracture was over-riding of the fragments with from one to three inches shortening.

Treatment: Under ether eleven cases were reduced by the traction method described above or a modification of it, and the fragments manipulated until the ends of the bone were made to engage. The leg was then straightened and a plaster spica applied, care being taken to have the anterior superior spine, the mid-patella, and the middle of the ankle in the same alignment as on the normal side. Reduction by this method failed in one case. A long side splint was applied and an X-ray explained the cause of failure. The fracture line began transversely, but about half way through the bone ran upward obliquely, and this long spike on the lower fragment evidently prevented the engaging of the broken ends.

In the ten cases in which the reduction had seemed satisfactory under ether, the X-ray showed a very good reduction with only slight displacement laterally in six cases; two cases showed engagement of the inner and outer sides of the fragments, *i.e.*, lateral displacement; one case showed postero-anterior edges engaged, *i.e.*, anteroposterior displacement; and one case showed over-riding with lateral displacement. A week's delay ensued before a radiograph was taken in the last mentioned case, and a second attempt to correct the deformity on the tenth day failed. A second X-ray two weeks after the injury showed a bony shadow in the region of the periosteal bridge and, as the leg had measured ¼ inch shorter than the normal leg, the condition was left uncorrected.

The incomplete fracture was straightened and a plaster spica applied.

Nine cases were treated by vertical suspension of both legs (the case in which primary reduction under ether failed is included). At the end of ten days, measurements and local palpation seemed to show a satisfactory result but the radiograph showed over-riding with lateral displacement in two cases which could not be corrected. In general the radiographs showed the same variety of replacement as in the reductions under ether, with this exception, that the spiral fracture showed some overlapping of the ends although the apposition was good. The extension was removed and a plaster spica applied as above.

The plaster spica was worn for ten weeks in all cases and the children allowed up and about in the twelfth week without support, except in the cases with over-riding in which union was not solid for from two to four weeks longer.

Massage and movement were employed after the plaster was removed.

Result: Six cases showed shortening of from one-eighth to three-eighths of an inch (the spiral fracture, the three cases with over-riding, and two cases treated by vertical suspension); and the most marked shortening occurred in the cases with overlapping of the fragments.

Solid union took place in all the cases with perfect function and no limp. There was no deformity other than the shortening mentioned above, except a slight anteroposterior bowing in the incomplete case and tilting of the pelvis in those cases with shortening. In one case (W., girl, age 5, Dr. Stimson's service, New York Hospital, 1903) treated by vertical suspension for a transverse fracture at the junction of the middle and lower third of the left femur, the note on discharge states that the leg was one-eighth inch short. Seven and one-half years later, Feb., 1911, the child came to the Out-patient Department of the New York Hospital for another condition, and at that time the two legs were of equal length. There was a difference of circumference of five-eighths of an inch four inches above the patella on the left side, *i.e.*, the left thigh was smaller than the right.

The writer has measured two other cases, six and four years after injury, but has found no apparent change in length from that stated at the time of discharge. Whether this discrepancy was due to error in measurement at the time of discharge or due to more growth on the affected side must remain unsolved.

Twenty cases of fracture of the middle two-fourths of the

femur in adults have been followed. The patients ranged in age from 15 to 76 years.

The line of fracture was transverse in ten and oblique in ten cases.

Shortening of the affected leg of from one to four inches was present on admission.

Five cases were treated by the Hodgins splint with additional traction as recommended by Dr. Stimson;[12] four cases were treated by a modification of the incline plane (the thigh piece was inclined while the lower leg piece ran horizontally as in the Zuppinger[13] apparatus) with additional traction by a weight pulling in the axis of the inclined thigh; ten cases were treated by Buck's extension on the Volkmann sliding rest with the counter-extension advised by Bardenheuer,[14] and one case was reduced under anæsthesia as soon as seen (v. infra).

At the end of from one week to ten days' extension, an X-ray was taken and measurements made. In none of the cases did these investigations show a complete end-to-end reduction of the fracture, but the apposition seemed satisfactory in all except four of the cases. In these four, the over-riding could not be overcome and they were operated upon by methods to be discussed later. Two had been treated by Buck's extension, one by the Hodgins splint, and one on the modified plane. Two were transverse in type and two were oblique fractures.

After three weeks' extension (15 cases), a plaster spica was applied for from four to six weeks and then a long side splint of moulded plaster, and massage, movements, and baking begun. Weight-bearing was permitted in the young adults in the fifteenth week, without support, but a short side splint was worn by the patients past 38 for from three to six weeks longer.

One case, John G. (House of Relief, May, 1911, Dr. F. W. Murray's service) was brought to the hospital while the writer was present. He was immediately anæsthetized and a transverse fracture of the mid-third of the left femur reduced by the traction method mentioned above. The two fragments seemed engaged and an X-ray taken at once showed the bones end to end with a little lateral displacement, as shown by the anterior view (Fig. 9). A plaster spica was then applied and a second set of radiographs made, which showed practically the same position as the first set, *i.e.*, there was no difficulty in maintaining the position obtained. The subsequent treatment was carried out by Dr.

R. T. Wheeler, of Brooklyn, at the patient's home. Dr. Wheeler reports that the patient has perfect function and no shortening.

In all but two of the above 16 cases there was shortening of from one-eighth to five-eighths of an inch. In the two cases without shortening, one was the transverse fracture in the patient John G., described above and the other was a long oblique fracture treated by the Buck's extension, etc.

Function was perfect in all the cases except one. In this last mentioned case a limp existed which disappeared when the heel of the shoe was raised one-half inch (there was five-eighths inch shortening).

Four cases were operated upon in the above list, and the operation in each case was done after the failure of some type of extension.

CASE I.—Julia R., age 50, New York Hospital, 1903, Dr. Hartley's service. Transverse fracture lower third right femur. Buck's extension. No union at the end of 14 weeks. Operation by Dr. Hartley, ends of bone freshened and a freshly prepared thigh bone of a chicken inserted into the medullary canal on both sides, two chromic sutures through drill holes in the bone, plaster spica. X-ray showed bones in perfect apposition. Primary union of wound. Bone solid in 71 days. The chicken bone could be seen in the X-ray picture up to the eighth month when it disappeared. Examination June, 1910: Perfect function, one-half inch shortening and no limp. The heel of the shoe was raised to compensate for the shortening.

CASES II and III.—One transverse, one oblique in anteroposterior direction, were operated upon after ten days' extension for deformity in over-riding. Deformity corrected, two heavy chromic gut sutures through drill holes in the fragments, plaster spica. Primary union of the wound in both cases (both were robust males 25 and 29 years of age). X-ray showed good but not perfect apposition in both cases and the bone was solid in 60 and 69 days respectively. Shortening of one-eighth inch in the transverse case and three-eighths inch in the oblique case. Function was perfect in both cases and the pelvic tilting readily compensated for the difference in leg length.

CASE IV.—R., Bellevue Hospital, Dr. Woolsey's service, 1910. Two inches shortening after traction for two weeks. Eight-screw Lane's plate for fracture at the junction of the middle and lower third of the left femur. Plaster spica with window. Afebrile

temperature for two weeks. On the fourteenth day a little pouting of the wound was found. This was opened and an abscess which contained the colon bacillus and which reached to the bone was emptied. The abscess was freely drained but the patient succumbed 27 days after the operation. The immediate cause of death was œdema of the lungs, due undoubtedly to the patient's inability to overcome the existing infection. The writer believes that the fault lay in his selecting this case for any type of operation, as the patient had a marked alcoholic history, arteriosclerosis, and was a bad operative risk. It would have been wiser to have left well enough alone despite the bad deformity which would have resulted (operation by Dr. Hitzrot).

Fractures of the Lower End of the Femur.—In this type are included only those cases of fracture of the condyles and the shaft immediately above them.

Six cases were fractures just above the condyles. Three were fractures of the internal condyle and one was a fracture of the external condyle with crushing of the articular surface of the external tuberosity of the tibia.

Four of the supracondylar fractures were almost transverse in type, the line of fracture running just above the internal condyle slightly obliquely outward. In one case the shaft penetrated the cancellous bone in the upper portion of the lower fragment.

The deformity was the same in all four cases, *i.e.*, outward displacement of the lower leg and genu valgum.

All were reduced under ether as soon as admitted, and the X-ray after reduction showed a satisfactory result in all except one case (M., Bellevue Hospital, 1909, Dr. Hartwell's service). In the latter open operation was done after a second attempt at reduction had failed, the bone fragments pried into apposition, where they remained without any further fixation.

Moulded plaster in all cases for ten weeks, then massage, baking, motion, etc.

In three cases the function was almost perfect, there being less than 5 degrees loss of flexion. In the operative case the knee was slightly more in the valgus position than on the normal side.

In the case with crushing of the lower fragment (Mrs. B. age 50, New York Hospital, 1909, Dr. Johnson's service), but in which the radiograph shows a perfect reduction, flexion

was limited to a right angle. After long use the knee was also painful.

Two cases were oblique fractures just above the condyles with the obliquity running from the anterior surface below upward and backward. In these there was the characteristic flexion of the lower fragment. Both were treated on the double incline plane with additional traction by adhesive plaster in the long axis of the thigh. In neither case was flexion of the lower fragment completely overcome. Solid union occurred with one-quarter inch shortening and limitation of flexion of from 10 degrees to 20 degrees, the latter being most marked in the case of the older of the two patients (J. B., age 57, Bellevue Hospital, Dr. Gwyer's service, 1907). Slight anteroposterior bowing was evident in the latter case, although the X-ray showed practically the same degree of reduction in both.

The three cases of internal condylar fractures were treated by reduction under ether and circular plaster. In all, the X-ray showed very little displacement, although the line of fracture was quite distinct and the long oblique upper end of the lower fragment could be seen projecting beyond the contour of the bone. Care was taken to have the leg alignment (anterior superior spine, mid-patella and mid-ankle line) the same as in the opposite limb.

Result: Perfect function without any deformity other than slight widening of the condyles in two cases. In one case (a female, Isabella W., Bellevue Hospital, 1908, Dr. Woolsey's service) the lower leg was adducted too much, so that there was less than the normal knock-knee on the affected side, but the function, etc., were as good as in the other cases.

In the case with fracture of the external condyle with a crushing fracture of the external tuberosity of the tibia, there was little displacement of the femoral condyle but marked genu valgum. The limb was adducted as much as possible and put up in plaster. Result: Genu valgum marked on affected side (the patient originally was slightly bow-legged) with limitation of flexion to a right angle. Later flat-foot developed in the foot on the affected side. An X-ray three weeks after reduction showed a nearly perfect reduction of the fracture of the femoral condyle but marked crushing of the articular facet of the external tuberosity of the tibia.

The Tibia and Fibula.—Eighty-five cases of fractures of

these two bones were followed; 15 cases were in children under 10 years and 70 cases were in adults between 17 and 60 years.

Types of fracture: In 35 cases the line of fracture was transverse, in 47 it was oblique, in one case it was spiral, and two of the cases were oblique fractures with comminution. In all except two of the cases the line of fracture in the fibula was at a higher level than that in the tibia, and in these two cases it was found at the same level.

No characteristic type of deformity, other than the angulation at the site of the fracture, change in the line of the tibial crest, and shortening of the tibia, was present.

All cases were treated by immediate reduction when seen and an anæsthetic was given for the reduction. Traction was made on the foot and counter-traction by a sheet over the body under the perineum. Then by local manipulation the fragments were brought into alignment, *i.e.*, the subcutaneous line of the tibial crest was brought into alignment. This was most easily done in children and in elderly individuals and with much more difficulty in robust muscular adults. It was also easier to approximate the transverse fractures than the other types. When reduction was accomplished, moulded plaster splints were applied which included the foot, ankle, and knee, first a posterior one and then a long U-shaped splint on each side, leaving the tibial crest free for determining any change in the line of the crest. The results were confirmed by X-ray pictures. At the end of two weeks the splints were so cut that motion in the knee became possible and massage was begun. In the third week baking of the ankle was begun.

In two cases of oblique fracture reduction was not considered satisfactory and a second reduction under anæsthesia was done within the first week. Perfect reduction was obtained in 30 of the transverse cases, and so nearly perfect in 37 oblique cases that one may call it so. In the remaining cases, 4 transverse, 10 oblique, 1 spiral, 2 comminuted, the alignment was good and the approximation sufficiently fair to warrant leaving the reduction.

Result: Delayed union occurred in two cases, one transverse and one oblique, which came under observation one week and ten days respectively after the injury with circular plaster about the unreduced fracture. Under anæsthesia the deformity was corrected as much as possible. Union became solid in one case in

four months (transverse), in the other case (V., New York Hospital, 1905, oblique), in six months. In both cases a leather laced brace was worn after the second month and the patient allowed to use the leg. In both cases slight bowing occurred in the tibia and shortening of three-eighths and one-half inches respectively. Function was perfect in both cases.

Slight lateral angulation at the seat of fracture caused bowing of the tibia with the concavity inward in 12 cases. In 21 cases there was shortening of the tibia from one-sixteenth to one-quarter inch. In two cases a distinct knob remained at the seat of fracture (excessive callus). One case developed flat-foot.

Function was perfect in all cases.

The time at which union became solid varied according to the age of the patient, *i.e.*, it occurred most rapidly in children (4 to 5 weeks), in young adults in from 5 to 8 weeks, and in the patients past forty in from 6 to 14 weeks. The two cases of delayed union mentioned above were in men past fifty but are not included in the above statement.

Pott's Fracture.—Sixty-four cases of this lesion were traced after one year from the time of the injury; 54 were in men and 10 in women.

All presented the picture typical of this fracture and all were treated by the method recommended by Stimson (*loc. cit.*). The splints were removed in from 5 to 7 weeks, most frequently at the earlier period. Massage and baking were begun in the second week and movement when the splints were removed.

In interpreting the results, it was necessary to separate those patients over 55 years of age from the others to get a fair idea of the actual end result.

Thirty-eight cases were in individuals under 35 years and all had perfect function, flexion and extension at the ankle-joint practically the same in both legs, and no pain.

Twelve cases were in patients between 35 and 50. Function was perfect in all the cases. Extension was normal, but there was distinct limitation of flexion in all. Two cases had pain, dull, aching in character after prolonged use.

Fourteen cases were in patients between 55 and 64. Function was perfect in four only, five had practically a stiff joint, and the remainder had motion enough to walk satisfactorily on the level but had difficulty on any incline and on steps. Flexion and

extension were limited in all and in five as stated above there was the barest possible motion. All had pain with barometric changes and 9 cases had pain after use.

CONCLUSIONS.

The writer believes that that method of treatment which offers the patient the most satisfactory functional result with the least danger should be the method of election in the treatment of the great majority of simple fractures.

That the future will show, as the cases above have shown, that the method which most nearly fulfils the above requirements is the non-operative reduction of fractures.

That the more experienced the profession becomes in the handling of fractures the better the results will be.

That operation must be considered not the method of election, but the method of selection for a carefully chosen group of cases, and that in selecting the types for operation, each case must be considered a law unto itself.

The writer begs to acknowledge his indebtedness to the attending surgeons of the New York Hospital and the Second Division of Bellevue Hospital for the material from which this study is made.

REFERENCES.

[1] Operative Treatment of Fractures, Lond., 1905; Practitioner, Feb., 1909; Surgery, Gyn., and Obst., April, 1909.
[2] Progressive Med., Dec., 1909.
[3] Jour. Am. Med. Assoc., 1909, vol. lii, p. 656.
[4] Surg., Gyn. and Obst., 1909, vol. viii, p. 120.
[5] Philadelphia, 1910.
[6] Graessner, Stuttgart, 1907.
[7] Stimson: Fractures and Dislocations, 1910, p. 289.
[8] Am. Jour. Med. Sc., July, 1905.
[9] ANNALS OF SURGERY, 1908, vol. xlvii, p. 984 *et seq.*
[10] Am. Jour. Orthop. Surg., 1909, vol. vi, p. 471.
[11] ANNALS OF SURG., 1908, vol. xlviii, p. 729.
[12] Jour. Amer. Med. Assoc., Feb. 5, 1910.
[13] Quoted by Bloodgood and by Bardenheuer, *loc. cit.*
[14] Bardenheuer u. Graessner: Ergebn. d. Chir. u. Orthopæd., Band 1, 1910 (literature).

LUXATION OF THE ULNA FORWARD AT THE WRIST (WITHOUT FRACTURE).

WITH REPORT OF A CASE.

BY F. J. COTTON, M.D.,
OF BOSTON, MASS.
First Assistant Surgeon in the Boston City Hospital,
AND
W. J. BRICKLEY, M.D.,
Resident Surgeon in the Haymarket Square Relief Station.

THE case herewith reported is presented, as such cases traditionally are, after a careful search of the available literature for data.

Probably we have missed a case here and there, but after all it is not important whether ours is the twenty-seventh or twenty-eighth.

Luxations of this type are so excessively rare that few men have seen them.

To bring to the attention of the profession a rare lesion that by its very rarity might prove perplexing, to satisfy curiosity as to its mechanism of production, and best of all to point out the method for its easy and efficient treatment—these things are perhaps worth doing.

On April 12, 1911, an Italian of about forty-five, strongly-made but small-boned, was brought into the Haymarket Square Relief Station of the Boston City Hospital.

Dr. Brickley, the surgeon on duty, recognized the lesion presented and its rarity, and called me up as a matter of interest.

When we examined the case together the condition shown in the sketches was conspicuous—a loss in the breadth of the wrist, an increase in depth (not conspicuous, however), and a very curious outline of the wrist seen from the back and from

the outer side. There was some limitation of motion; the hand was held in semipronation.

The detailed tests were in some degree less easy because the man spoke little English and was rather full of liquor.

The history (gotten then, confirmed next day) was that he was engaged in unloading beer-kegs from a wagon on to a platform that stood at about the height of his shoulder or a bit higher; he was pushing on a keg when it slipped or proved too much for his strength. Hand and radius were displaced suddenly backward from the muscularly fixed ulna. The hand and radius were dislocated backward by the sheer tearing of ligaments under force. In the usual phrase, the *ulna* was dislocated *forward* and slightly inward, so that it overlapped the radius a little in front. A glance at the sketches shows the character of the deformity better than it can be put into words (Fig. 1).

After the patient was anæsthetized, Dr. Brickley attempted reduction by traction combined with direct pressure on the displaced ulnar head. On suggestion he combined with these manœuvres a sharp pronation of the arm, and the bone slipped into its appointed place with a click. All motions became free and all deformity disappeared; splints were applied.

Next day the patient was sent to the "Main" City Hospital and there an X-ray plate was taken, a print from which is here reproduced (Fig. 2). There was no sign of any associated fracture. It has been impossible to trace this patient more recently, and our belief in a good resulting function is one of inference only.

This lesion—uncomplicated forward luxation of the ulna at the wrist—seems first to have been described in any adequate fashion in an article published one hundred and twenty years ago in the "Journal de Chirurgie par P. Desault" for the year 1791. This is in volume i, No. 1, page 78, and is but an extract of an unpublished talk by Desault delivered before the "Academie de Chirurgie" in the year 1777.

The case involved was a cadaver case, without history, but was undoubtedly a case of forward luxation of the ulna alone, without fracture.

Dupuytren saw and reported a couple of cases in his book published in 1834.

Malgaigne, later, collected a series of these cases, in his "Fractures and Luxations," which appeared in 1855.

Many years after, in 1874, Tillmanns[1] again worked up the subject and collected all records of ulnar luxations at the wrist, of which a minority were luxations of the ulna forward of the type with which the present paper is concerned. A more recent collection is by Baum, published in 1902.

Not all of these cases will pass, for in a number of them no account is taken of the question of associated Colles's fracture. Every working surgeon knows that forward subluxation of the ulna, or rarely total luxation, is an almost constant concomitant of this fracture, provided there has been any considerable displacement.

For our present purpose only the cases of *independent* luxation of the ulna forward are of interest.

It would not be fair to admit only those cases in which the X-ray shows no associated radial lesion, for many of the ancient reports bear evidence of very careful observation; yet it is fair to consider only such cases of to-day as have been so tested, to sift the cases of earlier years, and to admit only those that *seem* to belong to the class of forward luxations of the ulna at the wrist, *without* associated radial lesions.

The list later given is an attempt to sift these cases, and includes all cases we have been able to find that pass the test.

The lesion being rare has been the more carefully studied for that reason—a paradox familiar to every one who reads surgical literature; and there are as usual several theories of mechanism on record, and projected and applied reductions in plenty.

The facts seem to be as follows:

The lesion is rare; it occurs only as the result of much force, applied suddenly or slowly.

There seems to be two mechanisms at least: (*a*) forced

---

[1] Tillmanns: Archiv. f. Heilkunde, 1874, p. 249.

FIG. 1.

Sketches of the wrist before reduction—from the back and from the radial side. Note the narrowness of the wrist and the sharp edge of the radius next the hollow left by the ulna.

FIG. 2.

Skiagraph taken after reduction of the dislocation. There is no fracture.

supination (Cases 7, 8, 11, 12, 16, 20, 25); (*b*) direct backward shove on the hand with the ulna fixed by mechanical impediment (Case 15) or by the force of the triceps (Cases 3, 21, and our case).

The other mechanisms apparently different are probably reducible to one or another of these.

The lesion is a tearing loose of the lower end of the ulna from most or all of its ligaments, and its displacement forward. Rarely it goes only forward; in most cases there is clearly described the displacement outward so that the ulnar head somewhat overlaps the radius seen from the front, as in our case, coming to lie under the common flexor tendon group, deeply buried.

Pronation is lost; flexion, extension, and finger motion are only moderately interfered with.

The amount of hæmatoma and swelling, of pain and disability need not be very great.

The diagnosis is simple. The wrist is curiously narrow (see Fig. 1).

The normal prominence of the ulnar head at the back of the wrist is gone, and in its place is a hollow beginning above in a gradual slope, bounded at the side by the sharp edge of the radius, below by the rather abrupt edge of the now prominent cuneiform. The ulnar head is not nearly as obvious in front as one would expect; it is of course covered by the flexor tendons, but even at that the anteroposterior diameter of the wrist is not conspicuously increased.

Reduction in these cases is more difficult than one would expect. Dupuytren had good luck with direct pressure backward on the head (cf. Cases 2 and 3).

Boyer devised an elaborate scheme of reduction by shoving thumb and fingers between the bones front and back—a sort of *distraction* reduction. This worked fairly well (cf. Cases 7, 6, etc.).

Best of all perhaps is a combination of moderate traction with direct pressure backward on the ulnar head, *accompanied by forced pronation.*

This solved the trouble in our case, as it did in most of the listed cases.

The *form* of after-treatment is not of first importance. In only two cases (Cases 17, 24) was there any tendency to recurrence of the luxation.

Repair is prompt; in the vigorous young men of the series a fortnight was enough for apparently serviceable recovery, though no doubt another week or two of care would be wise.

The end results, in cases in which recognition and reduction of the lesion have not been unduly delayed, have been admirably good, practically always perfect.

LIST OF RECORDED CASES.

(The list is roughly chronological; the numbers are the reference numbers used in the text.)

1. DESAULT: Cadaver case; typical luxation; no history (*Journal de Chirurgie*, vol. i, No. 1, p. 78).

2. DUPUYTREN: Soldier of 32 years of age; fell with his horse. Type luxation; reduced by direct pressure.

3. DUPUYTREN: A builder thrust violently with his hand against a wall that threatened to fall, and so dislocated the ulna forward at the wrist. Reduction as in Case 2. (Dupuytren, *Lecons orales de Clinique Chirurgicale*, 1834, vol. iv, pp. 503 ff.)

4. PALLETTA: A slightly doubtful case; cadaver specimen; subluxation only (quoted in detail by Rognetta, *Archives gén. de Méd.*, 1834, ii S., Tome v, p. 405).

5. VALLETEAU (reported by Espiaud): Boy of 13, who had his wrist twisted in a moving wheel, received a *compound* forward luxation of the ulna. This was reduced and gave, in the end, excellent function.

6. VALLETEAU (reported by Espiaud): Cannoneer, thrown, and had wrist run over. Reduced by "Boyer's method," but without pronation. (Cases 5 and 6 were reported by Espiaud for Valleteau, *Gaz. Méd. de Paris*, 1836, ii S., Tome iv, p. 250).

7. BOYER: Luxation by forced supination of the wrist (wrist-twisting in a "scrap") in an elderly woman. Reduced by "Boyer's method," combining sharp pronation with the distraction manœuvre (quoted by Malgaigne, *Traité d. Fractures et d. Luxations*, 1855, vol. ii, p. 687).

8. GODELIER: Luxation by rolling of a heavy weight on to the fixed and supinated wrist. Reduced by abduction and pronation (quoted by Malgaigne, *loc. citat.*).

9. MALLE: Fall on the supinated arm. Reduced by "Boyer's method."

10. MALLE: Reduced according to Boyer (quoted by Malgaigne,

loc. citat., without details, with reference only to an inaccessible old military journal).

11. PARKER, of Liverpool: Man of 40, had his wrist pinned down by the shaft of a cart. The hand was supinated, and pronation was lost. Head of ulna under flexor tendons. Reduced by forcible pronation with direct pressure (quoted by Hamilton, "Fractures and Dislocations," 3d. ed., p. 117).

12. DUCHAUSSOY: Carpenter, 28 years old, caught in machine, in supination; reduced by abduction and flexion. Pronation and supination remained somewhat limited (*L'Union Médicale*, 1855, Tome ix, p. 575).

13. PURDOM (quoted as Purdon by Baum): Hand and arm caught between rollers of a planer (obliquely). Typical lesion, reduced by traction and pressure (*Edinburg Medical Journal*, 1874, xx, p. 325).

14. OHLEMAN: Man of 42; arm pinned between body of horse and crib. Hand thenceforth useless. Deformity typical. Reduction by traction and direct shove on the ulnar head. Perfect result (*Archiv. f. klin. Chirurgie*, 1875, xviii, p. 423).

15. R. F. WEIR: Woman of 48; hand and forearm caught in a dumbwaiter in supination. Type deformity. Reduction by direct thrust. Power to pronate returned promptly. Result perfect (*Hospital Gazette and Archives of Clinical Surgery*, New York, 1877, vol ii, p. 10).

16. STIERLIN: Man of 66; was putting on a belt (on shafting) when his hand was caught in supination. Type deformity. Reduction by pressure (*Correspondenz Blatt f. Schweiz. Aerzte.*, xix, 1889, S. 684).

17. BRIGGS: Woman of 72; fell with her wrist caught and jammed. Type deformity. Reduction by traction and direct pressure. Partial recurrence at 8 days; re-reduction. Final result excellent (*N. Y. Medical Record*, May 9, 1891, p. 553).

18. WEIZ: Quoted by Baum without a reference.

19. JONES: Male of 35. Was struck by the "kick" of a machine in the palm—given as over pronation (?). Type deformity with lost rotation, etc. Reduced by extension and *supination* (*Lancet*, 1893, i, p. 862).

20. WHITE: Hand caught in a belt. Type deformity. Reduced (under chloroform) by traction and direct pressure (*British Medical Journal*, 1893, i, p. 641).

21. KIRKBY-THOMAS: On board ship a man had his wrist struck by a heavy swinging loading hook. Typical deformity. Reduction by pressure and pronation (*British Med. Journal*, 1896, ii, 1774).

22. LEISTENDORFER: Soldier, hand slipped in exercise-vaulting and he fell over it. Type luxation. Reduced by abduction and pronation. Rapid and permanent recovery (*Deutsche Militar-ärztliche Ztschr.*, Berlin, 1896, xxi, S. 333).

23. BAUM: Male of 44 years; arm struck by a stone. Type luxation except that the ulnar styloid was broken (*Deutsche Ztschr. f. Chirurgie*, Bd. 67, 1902, S. 645).

24. VALLAS: Patient struck the ulnar side of the arm on a rail in falling. Typical displacement. Reduction by pronation, recurrence on

supination. Was again reduced by pronation. Some ulnar nerve tingling after this manipulation (*Lyon Méd.*, 1904, Tome 103, p. 885).

25. THON: Male of 50, had hold of a rope running over a limb. This hand was dragged over by the running rope in forced supination. Reduction by traction and pronation (*Deutsche Ztschr. f. Chirurgie*, lxxxiv, 1906, S. 257).

26. HAEDKE: Woman of 63, wrist twisted in a quarrel; thought to have been pronated. Typical volar luxation of ulna (*Deutsche Ztschr. f. Chirurgie*, 1907, vol. xci, p. 429).

27. HILL: Male, age 52 years, while cranking his automobile the motor back-fired, throwing his hand in violent supination, causing a rupture of the internal lateral ligament and anterior ligaments, and tearing the triangular interarticular fibrocartilage, resulting in a forward displacement of the head of the ulna where it could be felt under the flexor tendons with a very perceptible corresponding backward depression. The patient, when seen shortly after the accident, was suffering greatly. The pain was not materially increased by flexion and extension, but pronation and supination added greatly to his discomfort. Flexion of the forearm and pressing the head toward the sigmoid cavity of the radius during extension and counter-extension made reduction easy, but the application of splints for five weeks did not prevent redisplacement to some extent. Patient still complains of a weakness especially in pronating. There was no clinical manifestation of fracture of the radius nor did an X-ray picture show the slightest sign of one anywhere. (Personal communication from Dr. L. L. Hill, of Montgomery, Ala.)

OSTEOMYELITIS OF THE LONG BONES.*

A STUDY OF NINETY-FOUR CASES FROM THE CHILDREN'S HOSPITAL, BOSTON.

BY JOHN HOMANS, M.D.,

OF BOSTON, MASS.

Assistant in Surgery, Harvard Medical School; Surgeon to Out-Patients, Massachusetts General Hospital.

THE series of cases upon which this paper is based includes all those which have been treated at the Children's Hospital since the publication in 1904 of Nichols's [1] classic monograph, which placed the pathology and treatment of osteomyelitis upon a sound and enduring basis. A study of these recent cases, though it brings out nothing essentially new, emphasizes some tendencies of the disease which are certainly worth recording.

It is not my purpose to cover by a mass of statistics every side of this subject, but to illustrate the manner in which infection seeks out and works upon the different bones, the variations in the course and virulence of the disease, the value of the Röntgen ray in diagnosis and treatment, and, finally, the results of the treatment itself.

Localization.—In going over a long series of cases, it has been a very striking observation that the first evidence of disease has appeared at one end or the other of the infected bone. In other words, the history has generally shown that it was not the thigh, leg, arm, or forearm, which first became painful, swollen, and tender, but the hip, knee, ankle, shoulder, elbow, or wrist. In most of the instances in which the history has failed to give evidence upon this point, the Röntgen plates have supplied the lack by identifying the original focus of infection. In a few cases the disease has been so rapidly fatal that the primary focus has been impossible of identification, and in about an equal number, the infection has evidently invaded the shaft from the periosteum at a distance from a joint

* Read before the Boston Orthopædic Club, November 13, 1911.

Several years ago Stone[2] called attention to the fact that many infections of the long bones, which occur in or near the epiphyseal line, break out from the bone at that point, and may then produce an extensive abscess beneath the periosteum of the diaphysis with but slight involvement of the medullary cavity. While a study of this series does not show this to be a common occurrence, it does indicate that the primary focus is nearly always to be found in the end of the diaphysis, and that it frequently remains local or breaks out from the bone through the epiphyseal line without spreading far into the medulla of the shaft.

I submit the following figures to illustrate this point. Among 94 patients, the number of bones infected (excluding the lower jaw and the small bones) was 113. Of these 113, there is evidence in the history or Röntgen plates (or both) that in 95 the primary focus appeared in one or the other end of the diaphysis. To answer the possible objection that the neighborhood of the joint appears to be the original seat of disease only because the inflammatory products find their way to the surface most easily at this point, I will say that in no instance does the Röntgen plate contradict the history as to the position of the original focus, and moreover, as will be shown later, the study of a series of plates taken in the early stages of an extensive disease of any bone will generally disclose the original focus.

This same line of investigation gives evidence rather at variance with the findings of Le Conte,[3] recently published, with regard to the periosteal origin of infections of the medulla. Le Conte gives the impression that he considers the penetration of an osteoperiostitis into the medullary cavity a common occurrence. In the Children's Hospital series, this condition is the exception. In only eight bones out of 113 can this process be definitely shown to have occurred, though in the Röntgen plates the appearance of such a lesion is in marked contrast to the usual process originating in the epiphyseal end of the diaphysis (Figs. 1 and 2). In the rare instances, however, of an isolated process situated in the medulla

at some distance from one end, it is difficult to say whether the infection penetrated from the outside or not. Of such cases there are four in this series, and in six others there is no evidence whatever as to the position of the primary focus.

I think it may then be assumed that the great bulk of the infections are medullary in origin, and that their primary focus, certainly their earliest manifestation, is found near the epiphyseal line. With this in mind I have attempted to discover whether any particular bones show a preponderance of infections over others, or at one end over another. The following list records the result of this investigation:

Femur, upper end 24, lower end 15 (and one general infection of unknown origin).

Tibia, upper end 12, lower end 19 (and three general infections of unknown origin).

Fibula, upper end 3, lower end 4.

Humerus, upper end 9, lower end 0.

Radius, upper end 0, lower end 4 (and two general infections of unknown origin).

Ulna, upper end 1, lower end 1.

Clavicle, inner end 2.

This list speaks for itself. Disease of the bones of the leg is easily more common than that of the arm. Disease of the femur is somewhat more common than of the tibia, its nearest rival, and of all the regions affected the upper end of the femur presents the most numerous infections. The preponderance of infections of the bones of the leg makes it appear as if the wear and tear of locomotion were accountable for this selection. How far an actual blow or fall is the actual exciting cause, is not clear from the histories. It is generally mentioned, but when one considers the innumerable bruises of childhood it is not strange that some violence can be remembered to have preceded the disease.

Apparently, then, there is good reason to believe that there is something peculiarly open to attack in the region of the epiphyseal lines of the long bones. More than that, the ends of the bones supporting the body are more frequently affected than those of the upper extremity. Possibly the character of the blood supply of the growing part of the bone renders

this point particularly vulnerable. Whatever the cause, it is interesting to study the course of these infections according to the anatomical relation of the various epiphyses to the different bones, for if the disease can more easily break out into the soft parts in one region than another, or if perhaps one end of a shaft offers a better structural resistance than another to the spread of infection, we should expect to find variations in the frequency with which each bone becomes completely invaded. There might, indeed, be variations according to age, but as all the children in this series are under twelve and rarely over ten, the differences in the degree of union of the epiphysis with the shaft would probably be negligible.

The following table records the number of infections originating at either end of each long bone, the number of general infections resulting, the percentage of general infections to the total number of infections in each locality and in each bone, the number of general infections of unknown origin, and the number of cases of local disease in the middle shaft. The term general infection refers to a condition in which at least two-thirds of the shaft becomes necrotic.

Origin of infection at upper end		Gen'l infections resulting	Gen'l infections to total No. of infections of upper end	Origin of infection at lower end	Gen'l infections resulting	Gen'l infections to total No. of infections of lower end	Gen'l infections of unknown origin	Mid-shaft infections	Gen'l infections to total No. of infections
			Pct.			*Pct.*			*Pct.*
Femur	24*	3	12.5	15	4	26.6	1	1	20
Tibia	12	5	41.6	19	5	26.3	3	7	34.2
Fibula	3	3	100	4	0	0	0	2	33.3
Humerus	9	3	33.3	0	0	0	0	2	27.3
Radius	0	0	0	4	4	100	2	0	100
Ulna	1	1	100	1	1	100	0	1	66.6
Clavicle (inner end)	2	1	50	..	..	....	0	0	50

*A number of infections classified in the records as osteomyelitis of this region have been excluded though abscesses in the soft parts appeared to lead to bone, either because of a lack of absolute proof of bony involvement, or on account of a possible tuberculous origin.

Perhaps these tables offer too few cases for safe generalization, and possibly the means of identifying a certain portion of the bone as the seat of the primary focus are inadequate, but even if these objections are valid, and I think they are not, the conception of osteomyelitis as a disease originating in or near the epiphyseal line is at least strongly suggested. The upper end of the femur is easily the most common seat of the primary focus, and furnishes as well the lowest percentage of general infections. Taken as a whole, the femur shows a smaller proportion of general disease than any other bone, though its lower end does not differ in this respect from the lower end of the tibia. Examination of the Röntgen plates and operative findings leads to the observation that disease of the upper part of the shaft originates commonly beneath the great trochanter, the head, and the lesser trochanter, the three epiphyses of this region. That such foci should break out to the surface without dissecting up the neighboring periosteum is not strange when we remember the powerful character of the muscular attachment about the upper end of the bone. The failure of the general shaft to become involved is apparently due to the ease with which the inflammatory products can escape from beneath the epiphyses as well as to the solidity of the structure of the upper part of the shaft. The Röntgenographs which illustrate this localized hip infection (Figs. 3, 4 and 5) are taken, in part, from an excellent study of this subject by Legg and George.[4]

This peculiarity of the femur is all the more remarkable in view of the fact that in both the tibia and fibula general infections more often start from above than below, a tendency which we might perhaps expect as an effect of gravity on drainage. In this respect the humerus can perhaps be placed in the same class with the tibia and fibula, though as there are in this series no records of disease of the lower end, the comparison is not quite fair. This freedom on the part of the end of the humerus which enters into the elbow-joint seems rather extraordinary, considering that the elbow is pretty severely battered in childhood. It indicates, perhaps, that blows and falls are not a very potent influence.

In the smaller bones general infections are the rule, though the total number of cases is small. There are no striking peculiarities among these bones, except that the upper end of the radius shares with the lower end of the humerus a complete freedom from disease.

Variations in the Course and Virulence of Osteomyelitis.— The variations in the course and severity of the disease are well illustrated in this series. In some instances a mild attack has never required operation, and the only evidence of its passage has been a slight alteration in the bone, as shown by the Röntgen ray. In others the onset has extended over months and the cure required a very minor operation. In such cases the diagnosis of rheumatism or tuberculosis is often made. In most instances the onset has been sudden and violent, and the full extent of the destruction of bone has taken place in a few days to two weeks. In the less virulent of these typical infections, the breaking out of the process from the epiphyseal line has saved the medulla from complete destruction, in much the same way that it is saved by operation, but in the most rapid, the child has died of toxæmia before local evidence of trouble was fully apparent.

Use of the Röntgen Rays in Diagnosis and Treatment.— While there is no one more valuable aid in the diagnosis and treatment of osteomyelitis than Röntgen plates, the use of this aid is subject to one most important limitation, which has frequently been illustrated at the Children's Hospital. It appears to be a fact that, according to the greater or less rapid destruction of bone in any one case, the Röntgen plate may lag more or less behind in revealing the full amount of damage. Not enough is known, perhaps, of Röntgen ray pathology, so to speak, to say just how soon after a portion of bone has become cut off from its blood supply it will cast an altered shadow upon the plate. And again, a fair plate may not even suggest what a perfect plate will clearly show. Under the circumstances, it is perhaps fair to say that positive evidence in plates taken during the first few days of an acute disease is most important in establishing a diagnosis and localizing the

FIG. 1.

Osteomyelitis of the femur, periosteal origin. Plate taken one year after onset. Compare with Fig. 2, another view of the same bone.

FIG. 2.

Osteomyelitis of the femur, periosteal origin. Plate taken one year after onset. Compare with Fig. 1, another view of the same bone.

FIG. 3.

Osteomyelitis of the femur. Origin in the region of the great trochanter. Plate taken six weeks after onset.

FIG. 4.

Osteomyelitis of the femur. Origin beneath the great trochanter. Plate taken eight months after onset.

FIG. 5.

Osteomyelitis of the femur. Origin in the region of the great trochanter. Plate taken five months after onset.

FIG. 6.

Osteomyelitis of the femur. Subacute onset Plate taken nine days after onset.

FIG. 7.

Osteomyelitis of the tibia. Total destruction. Plate taken seven weeks after onset. Resection at this time of the entire sequestrum was followed by regeneration in 30 days

FIG. 8.

Osteomyelitis of the humerus. Plate taken Feb. 17, 1911, six days after onset. At this time there was found an extensive abscess beneath the deltoid, pus under the periosteum for three inches downward from the epiphyseal line, and pus in the upper end of the medulla of the shaft extending downward from the epiphyseal line for about an inch. Notice the faintness of the indications of bone disease.

FIG. 9.

Same case as Fig. 8. Plate taken March 7, 1911, 24 days after onset. The bone has been widely opened to just below the lowest piece of metal shown in the print. Notice the irregular small areas of suppuration below this point and the extent of the periosteal thickening.

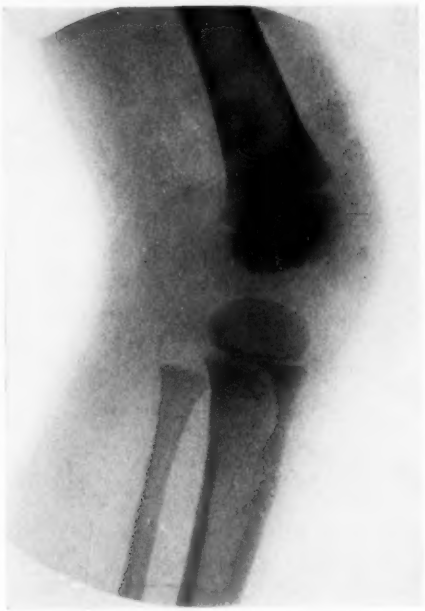
FIG. 10.

Same case as Figs. 8 and 9. Plate taken eight weeks after onset. Notice regeneration of bone at site of operation and the density and extent of the new periosteal bone.

FIG. 11.

Same case as Figs. 8, 9, and 10. Plate taken seven months after onset. Arm had been healed for three months. Notice welding of periosteal new bone with the shaft.

FIG. 12.



Osteomyelitis of tibia. Plate taken Feb. 8, 1911, ten days after onset. Notice outline of necrotic bone in upper one and a half inches of the shaft next the epiphysis.

FIG. 13.

Same case as Fig. 12. Plate taken March 11, 1911, seven weeks after onset. Notice regeneration of bone at site of operation, and extent of periosteal thickening.

FIG. 14.

Same case as Figs. 12 and 13. Plate taken seven months after onset. The leg has been healed for several months. Notice disappearance of the thickened periosteum.

process, but that negative findings under these circumstances should not be taken seriously, nor positive as indicating the full extent of the lesion.

Fig. 8 shows the upper end of the humerus in a boy of eleven years, who had suffered from severe local symptoms for six days before entrance. There is in the plate but very slight evidence of disease, and yet operation performed at once disclosed an abscess in the upper end of the shaft, extending down for an inch below the epiphyseal line, and pus under the periosteum for two inches farther down. Fig. 9 is a later plate of the same case, and shows that the medulla below the obvious pus cavity in the bone, which appeared normal in the first plate and at operation, was the seat of a less active process which only became visible considerably later.

On the other hand, in locating a well-established focus and in following the changes in the bone once the disease has ceased to advance, the Röntgen plate is absolutely invaluable. It directs the operator to the exact focus (Fig. 6); it advises him of the extent of the necrotic bone (Fig. 4); and it enables him to follow the development of the periosteal new bone, so that he may time his secondary operation correctly, and remove as much necrotic shaft as is necessary at the time when the involucrum is ready to grow into its place (Fig. 7).

Treatment.—Inasmuch as the 94 patients in this series have been treated by a considerable number of surgeons, the treatment has been too varied to be effectively summarized. On the whole, conservatism has been the rule, and the results, so far as I have been able to obtain them, seem to be good (see table). There are in all twelve total resections, and by this I mean a resection of the entire thickness of the shaft for at least two-thirds the length of the diaphysis. These I have divided into three classes: first, those performed immediately after the onset of the disease, before the periosteum has had an opportunity to thicken; second, those performed at the time of election some weeks after the beginning of the infection, according to Nichols's dictum, the periosteum being sewed together and made into a collapsed tube; and last, those

performed as in the second class, with the difference that the wound has been packed wide open.

In the first class are two cases:

(1) W. B. Right tibia. Acute onset. General swelling of leg with cellulitis. Subperiosteal resection six days after onset. Periosteum sutured. Result, incomplete regeneration requiring transplantation of fibula. (2) E. C. Left fibula. Acute onset. Cellulitis. Subperiosteal resection three days after onset. Periosteum partly sewed up and the cavity drained with a rubber tube. Regeneration complete.

There are unfortunately too few of these cases from which to draw conclusions. As far as it goes the evidence is against early resection.

In the second class are four cases:

(1) I. S. Left clavicle. Subacute onset. No operation performed for five weeks after onset, when the whole diaphysis was resected subperiosteally and the periosteum sewed up without drainage. Result, complete regeneration. (2) M. D. Osteomyelitis (possibly syphilitic) of right radius. Subacute onset. Subperiosteal resection of most of shaft five weeks after onset. Periosteum sewed up. Result, regeneration after some delay and a minor operation. (3) G. W. Left ulna. Acute onset. Subperiosteal resection six weeks after onset. Periosteum sewed up. Complete rapid regeneration. (4) L. U. Right tibia. Acute onset. Subperiosteal resection seven weeks after onset. Periosteum closed and drain placed at both ends. Complete regeneration in thirty days.

These cases, in which the septic process had died out by the time of the secondary operation, were treated in practically the same way, and in three, excellent results were obtained. The fourth, which was probably syphilitic, did very well while she was followed, but has since been lost to sight.

In the third class are five cases:

(1) D. B. Left ulna. Acute attack. Subperiosteal resection five weeks after onset, the bone being removed in fragments and the wound packed wide open with gauze. Regeneration complete. (2) E. D. Left tibia. Acute onset. Subperiosteal resection nine weeks after onset. Wound lined with rubber

tissue and left wide open. Regeneration complete. (3) A. K. Right fibula. Acute onset. Subperiosteal resection seven weeks after onset. Periosteum closed in central part but cavity drained with iodoform gauze. Wound later required irrigation. Result, partial regeneration. Perfect function. (4) A. M. T. Right tibia. Acute onset. Seven months after onset thick involucrum opened and necrotic shaft removed. Packed with gauze. Result, regeneration with poor cosmetic result. Right humerus. Acute onset. Seven and one-half months after onset thick involucrum opened and necrotic shaft removed. Packed with gauze. Result, regeneration. (5) J. McC. Right fibula. Acute onset. Three months after onset thick periosteum opened and bone removed in fragments. Cavity lined with rubber dam. Result, unknown (patient cannot be traced).

These cases, of the same character as the last, show one failure, but the total number is too small from which to draw conclusions. As far as the results go they speak against packing the periosteal shell with gauze.

I have purposely refrained from discussing at any length the refinements of treatment in complete subperiosteal resection, because I have been unable to see that the results differ very essentially whichever method is used, though, for reasons which will appear later, I cannot believe that any real advantage of the immediate resection outweighs its danger of failure. This brings me to the matter which seems to me far more important than the resection of totally necrotic bone, a step which, like amputation, is, in a way, a confession of failure. I allude to the treatment of the cases in which the disease has remained local, or in which it has not yet infected the entire medullary cavity. Here the primary operation, the one performed when the surgeon first sees the patient, is of the greatest importance, for it is upon this that the excellence of the ultimate result really depends.

The early or primary operation has for its object the saving of life and the limitation of the septic process, two requisites which go hand in hand. In this series there has been an immediate mortality of 7.36 per cent. or 7 cases out of 94.

It is significant that in five of these cases the infected bone was not opened. In another, the bone was opened, and in the last, the history is deficient.

The importance of draining the infected medulla has been too long recognized to require emphasis, and no one ought to hesitate to remove a portion of the cortex, even in the presence of an extensive periostitis, when infection within the bone is in the least suspected. It is in the direction of where and how to drain the bone that this series seems to me to indicate the way, for it has been noticeable that when a painstaking effort has been made to find the original focus and to follow the pus until sound tissues are reached, a secondary operation has been practically unnecessary or minor in character. The principle that the disease almost always starts next to the epiphysis is, therefore, of tremendous importance. The fact that the Röntgen ray will not always indicate the full extent of a process less than a week old is hardly less to be considered. Finally the point made by Nichols, that the endosteum should not be destroyed by reckless curetting, is a third and obvious consideration. The results of treatment carried out on these lines in early acute cases will justify the statement that if the diagnosis is in any way prompt, the actual removal of much of the shaft is a confession of failure. I shall quote from two histories in some detail to illustrate these points. In neither is the treatment free from minor mistakes.

Case I.—C. F., male, age eleven years. Previous history negative. Entered hospital February 17, 1911. Had an attack of "grippe" for three days, two weeks before. Rather poorly until six days before, when he had pain in left shoulder. Shoulder swelled. Diagnosis rheumatism. Physical examination: local heat, swelling, and œdema, in front of left shoulder-joint and a little way down front of arm. Temperature 105.2°. Aspirated and pus obtained. Röntgen plate shows questionable lesion near epiphyseal line (Fig. 8). Operation at once. Deltoid incised about an inch inside bicipital groove. Abscess beneath deltoid. Periosteum tense and fluctuant. Abscess beneath it from bicipital groove outside to back of arm, and for three inches

down the shaft. Rough friable bone next to epiphysis on inner posterior surface. Opening one inch square, made with gouge, disclosed abscess in bone with most of pus welling up from behind. Enough of medullary structure curetted out to allow free drainage. Narrow slit chiselled downward for about one inch more, showed healthy looking cortex and medulla. Gauze drainage. *Staphylococcus aureus* in culture. Temperature fell to 100.4° in two days and then rose again.

Feb. 22, five days after operation, opening made in back of shoulder-joint and cloudy fluid escaped. Joint drained with rubber tissue. At same time the opening in inner side of the humerus was rongeured out to the extent shown in the Röntgen plate (Fig. 9). Did well and was healed May 1. On March 11 an infection of the right hip was drained and subsequently healed without complication. No bone involved. On May 14, about three months after original operation, sinus opened of itself at the upper end of the wound in the arm. May 19, secondary operation. Old scar in front of shoulder excised. Involucrum covered old opening in the bone as did a second layer of bone beneath it (evidently from the endosteum, which was as little disturbed in the first operation as possible). (See Röntgenograph taken April 6, Fig. 10.) A clean hole about the dimension of the original was rongeured out and some spicules of dead bone removed. After this, healing was uneventful. Seen in September when the arm had been healed for several months. No disability. Upper part of the bone thick and irregular. Röntgen plate shows that the periosteum which had grown new bone over practically the entire shaft was welding with it (Fig. 11).

This case illustrates the common mistaking of osteomyelitis for rheumatism, the partial failure of the Röntgen ray to demonstrate a lesion six days old, the location of the infection near the epiphyseal line, the free opening of the bone (not far enough at the first operation as it turned out), and the subsidence of the rather general bone infection, as shown by the Röntgen plates, after drainage. The result is not ideal, but shows the possibilities of regeneration of bone, which at first sight appeared necrotic, through the avoidance of unnecessary injury.

Case II.—R. H., male, age five years. Past history negative. Entered hospital February 8, 1911. Ten days before entrance

had had a sore throat. Said to have struck right leg against a tree and had complained of pain in lower leg. Swelling of upper right leg just below knee first noticed five days before entrance. Local heat and swelling below right knee extending several inches down the leg. Temperature 102°. Röntgen plate shows disease in upper shaft (Fig. 12). Operation at once. Incision for three inches over inner surface of tibia just below knee. Pus under periosteum and coming from posterior surface. Through a second incision in front of the fibula the posterior and outer surfaces were curetted off downward from the epiphyseal line for one and one-half inches. Cigarette drain. Streptococcus in culture. Good recovery. Successive Röntgen plates show extensive periosteal reaction and rarefying of bone for upper three inches (Fig. 13). April 5, two months after first operation, a small fragment of dead bone was removed and healing from then on was uneventful. Final condition shown in Fig. 14 (plate taken August, 1911). No lameness. About one-half inch lengthening of right tibia.

This case illustrated the success of the thorough early operation and the completeness of repair without subsequent treatment of any importance. Unlike the first case quoted the periosteal new bone which seemed at one time to be forming about the upper part of the shaft disappeared later and left a normal looking cortex. The cause of this difference is one of the mysteries surrounding the behavior of the periosteum.

There is only one more important feature of the treatment of osteomyelitis which this series brings out. This is the effect of rest on healing. Many cases have recovered with good results under traction by hip splints or other forms of immobilization. In some instances a minimum of drainage, followed by long-continued rest and freedom from weight-bearing, has brought about excellent function, but it must be acknowledged that the healing though finally complete has been slow. Such results emphasize the obvious importance of freedom from strain during the repair of bone.

The following summarizes the ultimate results in so far as it has been possible to follow the patients:

Seven died as an immediate effect of the disease.

Forty are alive and well and have a perfect functional result. Of these, three had multiple infections.

Nine are stated in the Out-Patient records to be healed and in good condition, but have not been seen since.

Eleven have healed wounds but some deformity which in no case is disabling.

Seven have unhealed wounds.

Twenty have not been heard from since leaving the hospital.

CONCLUSIONS.

1. Osteomyelitis of the long bones in children originates in the ends of the diaphyses—rarely as a periostitis.

2. It principally attacks the weight-bearing bones.

3. The early or primary operation demands the removal of bone for purposes of drainage only. The infected medulla should be fully uncovered without doing unnecessary damage to the periosteum or endosteum.

4. Considering the power of regeneration of periosteum plus endosteum, early complete resection of a shaft is not advisable; therefore total resection later should be reserved for cases of total necrosis.

5. The Röntgen ray cannot be depended on for diagnosis in the very early stages, but is invaluable in following the course of the disease.

I am indebted to the Röntgenologists of the Children's Hospital, for the plates which illustrate this article, and to the members of the staff for permission to study their cases.

REFERENCES.

[1] Nichols, E. H.: Acute, Subacute, and Chronic Infectious Osteomyelitis, Its Pathology and Treatment, Journ. Am. Med. Assoc., 1904, xlii, pp. 439-466.

[2] Stone, J. S.: Acute Epiphyseal and Periosteal Infections in Infants and Children, Boston Med. and Surg. Journ., 1907, clvi, pp. 842-848.

[3] Le Conte, R. G.: Acute Inflammation of the Long Bones with Especial Reference to Excision of the Diaphysis, Boston Med. and Surg. Journ., 1911, clxiv, pp. 771-776.

[4] Legg, A. T., and George, A. W.: Non-tuberculous Bone Infections about the Hip-joint, a Clinical and Röntgenological Study, Boston Med. and Surg. Journ., 1908, clix, pp. 361-364.

THE DIAGNOSIS OF DIAPHRAGMATIC HERNIA.

BY H. Z. GIFFIN, M.D.,

OF ROCHESTER, MINNESOTA.

Attending Physician to St. Mary's Hospital.

In obtaining clinical histories from patients, it is well to inquire as to former injury much as one would ask about previous disease or operation. In this manner a clue may be obtained which will occasionally lead to eliciting data of vital importance in the diagnosis. This point is forced upon one's attention in reviewing the reported cases of diaphragmatic hernia. The history of trauma is very important evidence, as will be shown later.

For a discussion of the embryology, anatomy, and pathology of diaphragmatic hernia and related conditions, the reader is referred to articles by Sailer and Rhein, Strüppler, Königer, Beltz, and Becker. Further discussion on the diagnosis will be found as well. It will be impossible to give credit in the text to all authors whose papers have been reviewed. German clinicians have been very thorough in their study of diaphragmatic hernia, and we are indebted to them for most of our information. The fact that little has been written in English upon the differential diagnosis has led me to prepare this discussion.

Many diaphragmatic hernias are congenital, but most of these have been found in stillborn babes or in infants. Hernia occurs through the various normal apertures of the diaphragm. Hernia into the pericardial sac has been reported. Right-sided hernias have, as a rule, been small and have contained a small knob of liver. The stomach has been found in the right side of the chest in one instance. Nearly all diaphragmatic hernias, however, are left-sided, and the subject will therefore be reviewed from this stand-point. Most important for diagnosis are the congenital hernias of adults and traumatic hernias.

About 650 cases of diaphragmatic hernia have been re-

ported. Strüppler collected 500 cases in 1901. One hundred and seven reported cases have been found since then, and in addition 41 references have been collected which the writer has been unable to confirm personally. Most of these were either congenital hernias of babes or symptomless hernias discovered at autopsy. It would seem that 15 cases were diagnosed correctly during life. It is safe to say, however, that many mistakes have been due to the fact that the physician was unprepared for the condition; that the symptoms and signs of diaphragmatic hernia were often quite clear but were not elicited because of lack of familiarity with them. On the other hand, an occasional case has been reported in which all the refinements of Teutonic technic have failed to differentiate the condition.

The most important and difficult differentiation to make is that between diaphragmatic hernia and *elevation of the diaphragm* (*eventration*). "Eventration" of the diaphragm was applied by Petit in 1790 to the condition of chronic idiopathic unilateral elevation of the diaphragm described by him. About 20 cases have been reported in the literature. As Königer suggests, it is not a good term surgically. The surgeon understands by eventration the condition in which a large part of the abdominal viscera is outside the peritoneal cavity. In fact, the word eventration might well be applied to diaphragmatic hernia, but not to high position of the diaphragm. Elevation of the diaphragm would be a better term; it is concise and its meaning is clear.

Elevation of the diaphragm is not an operative condition. Diaphragmatic hernia is generally surgical. The importance of deciding between the two conditions is therefore increased. Cases of elevation have been diagnosed hernia and unnecessarily operated upon.

The diagnosis can best be discussed in a consideration of (1) the clinical symptoms, (2) the physical signs and (3) the radiographic and fluoroscopic findings.

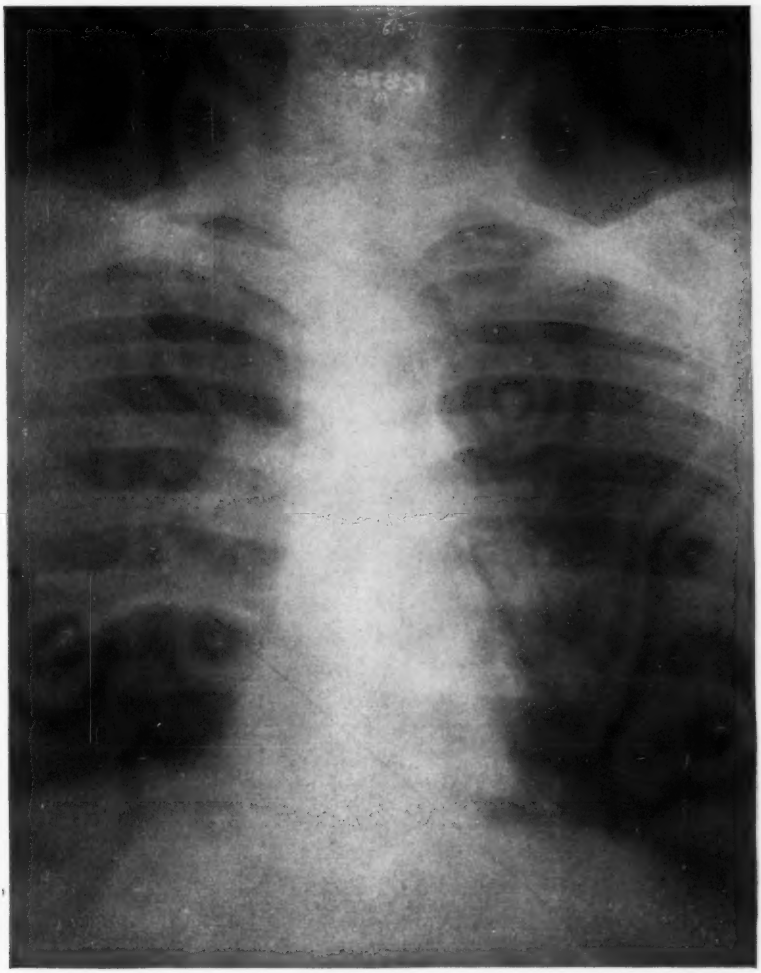
If a history of severe trauma be elicited,—a crushing injury to the lower thorax or upper abdomen, as would occur if a man were caught between buffers; a severe blow to the upper

abdomen or lower thorax, as in being struck by a flying plank; a severe twist with consequent strain upon the organs of the upper abdomen and the diaphragm, as in being jerked suddenly from one position to another; a sudden doubling of the body with chest between knees, as in a sand or gravel slide; a penetration of tissues in the region of the diaphragm, as in a stab wound,—the existence of rupture of the diaphragm should be suspected. In the acute condition, marked dyspnœa with severe upper abdominal and left thoracic pains, possibly with symptoms of intestinal obstruction and hæmatemesis, completes the clinical picture.

Chronic cases of hernia, either congenital or traumatic, may give a less striking symptomatology and a history of much less severe injury. In this they approach the symptoms of elevation of the diaphragm, where abdominal pain, dyspnœa, and vomiting, though less severe, may recur in attacks, and these may be worse after trauma without rupture being present. Elevation is generally a congenital condition. A prominent symptomatology may only follow trauma. Dyspnœa, pain, indefinite gastric complaints may be of varying grades. Hæmatemesis has been reported. It is in these chronic cases then that the physical findings and radiographic and fluoroscopic study are more important.

Tympanitic percussion note, distant breath sounds, gurgling and tinkling sounds over the left lower chest, with hyper-resonant note and normal or slightly altered sounds over the left upper chest are common to both conditions. The heart is displaced to the right. In diaphragmatic hernia Litten's sign may be absent, and it has been suggested that the line of tympany may be less movable than in elevation. Dulness below tympany has been noted in diaphragmatic hernia and is probably explained in one case on record by the presence of spleen and in another by omentum. After giving a Seidlitz powder the signs may be much clearer and expansion of the stomach upward is likely to be more decided in hernia. Filling the stomach with water will cause partial flatness in place of tympany. Air or water pumped into the colon will likewise affect the tympany in the chest, if the

FIG. 1.



June 26, 1911. Case, diaphragmatic hernia, with the stereoscopic radiographs made of patient in the vertical position, the sternum next to the X-ray plate, care being taken to avoid any rotation of the spine on its long axis. The central focus corresponds to the level of the seventh dorsal vertebra.

We are viewing the thorax through from behind, therefore the right side of the print represents the right side of the thorax. These prints are facsimile reproductions of the original plates.

Note the position and outline of the pericardial shadow. The heart inclines strongly toward the right, its right border extending a greater distance to the right of the midsternal line than does the left border to the left of the spine.

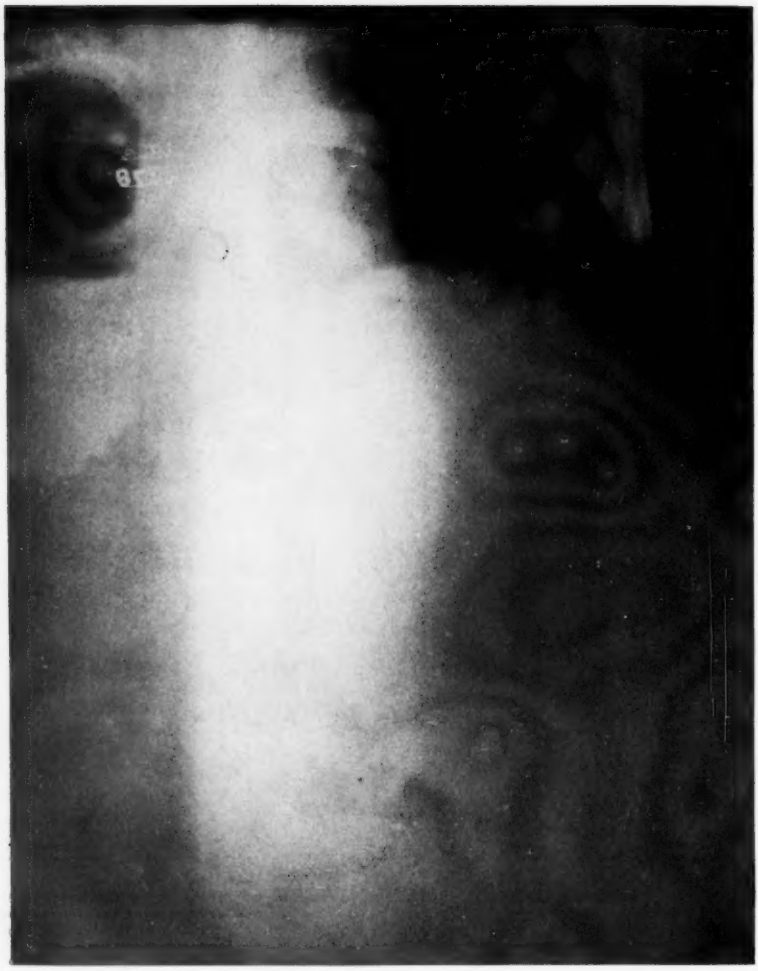
Both hiluses are abnormally dense, the left being markedly enlarged. Both apices are clear, and the pulmonary tissue is normal in all three right lobes and in the upper left lobe.

In the lower portion of the left thorax can be seen clearly a curved white line of greatly increased density. The proximal end of this line is opposite the level of the spinal juncture of the eighth rib on the left side. From this point the line curves outward along the eighth interspace to the ninth rib. Between this line and the upper border of the tenth rib is seen a dark area of greatly decreased density, through which one can clearly distinguish branches from the lower pole of the left hilus. The costal portions of three ribs are also visible. The left margin of the pericardial shadow is not clearly defined.

Note the clear-cut outline of the dome of the diaphragm to the right of the spine and compare it with the faint, indistinct outline on the left of the spine, which is to be seen just below the tenth rib.

The unusual appearance of the lower portion of the left thorax attracted our attention and suggested strongly the probability of a hernia of the diaphragm. A study of the stereoscopic plates supported this suspicion, and it was deemed important to establish the position of the stomach, for it seemed likely that the dark shadow below the abnormally placed curved line was due to gas in the stomach. With this end in view an emulsion of subcarbonate of bismuth and acacia was given the patient by mouth and a second set of plates made immediately, the patient being in the vertical position. (See Fig. 2.)

FIG. 2.

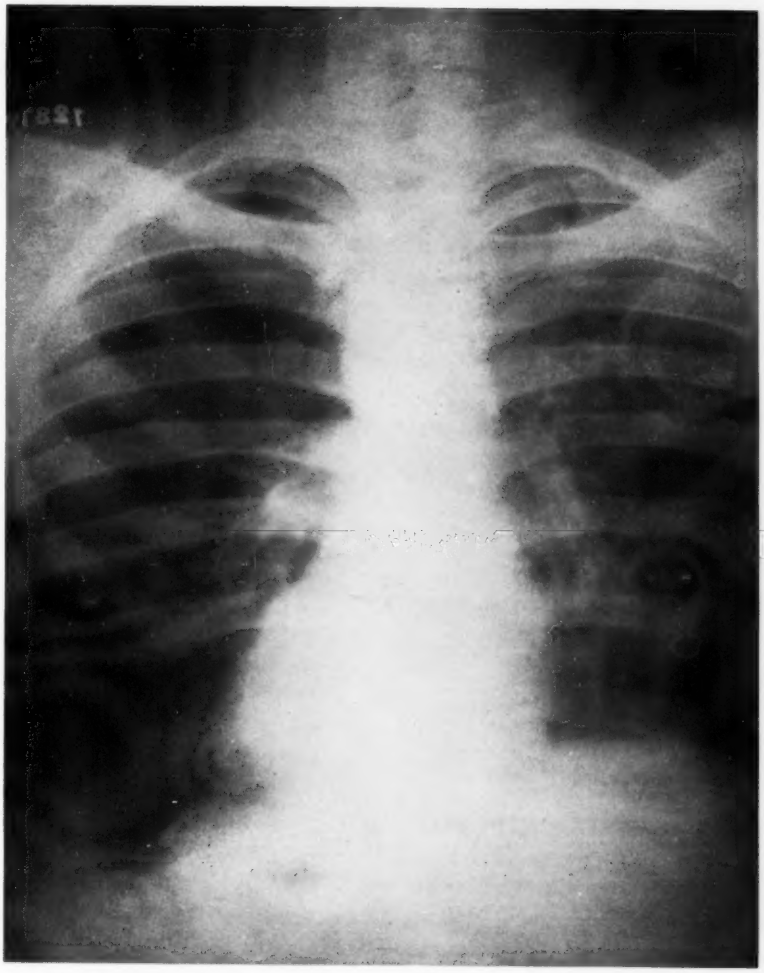


Radiographed immediately after the ingestion of bismuth subcarbonate emulsion. Compare with Fig. 1.

Note the line of demarcation between the white dense area and the dark area lying above it. The white shadow represents bismuth in the stomach, the upper border of the shadow representing the surface level of the emulsion. Above the bismuth is seen the gas bubble of the stomach. This is limited above by the wall of the stomach which we recognize as the curved line described in Fig. 1. Note the faint outline of the bismuth lining the œsophagus. This can be traced upward to the limit of the plate. Figs. 1 and 2, together with the history, confirmed the diagnosis of hernia of the diaphragm.

Important diagnostic points demonstrated by the radiographs, Figs. 1 and 2: (1) the presence of a dark circumscribed shadow situated above the indistinct outline of diaphragm on the left side and bounded above by a curved dense band which does not maintain the dome shape typical of the normal diaphragm line, and limited mesially by the left border of the heart which is displaced strongly to the right; (2) the presence of the shadows of the lower branches of the left hilus showing through rarified area; (3) the location of the stomach and its great bubble by bismuth ingestion method.

FIG. 3.



Two weeks after operation Compare with Fig. 1. Patient's pose is the same as in Fig. 1. (1) Note the absence of the curved white line described in Fig. 1; (2) the dense white area just to the left and below the nose of the heart represents the operation scar; (3) the heart has returned almost to its normal position; (4) there is a marked difference in density in the two sides of the chest; the left is darker, indicating a pneumothorax and partial collapse of the pulmonary tissue incident to the operation upon the diaphragm.

colon be part of the hernia; if this finding be definite it may be regarded as an important point in favor of hernia. Examination after changes in position may furnish some evidence.

In radiograms of either condition the most noticeable abnormality is the existence of a curved shadow line with concavity downward in the left chest, and the problem is to determine whether this shadow line represents stomach wall as in hernia, a high diaphragm as in elevation, or both stomach wall and diaphragm as in elevation. (1) The shadow of elevation generally maintains a typical dome-shape whether it be low or high, or whether the radiograph be taken before or after distention of the stomach with CO_2. The shadow of hernia may vary in outline, may be irregular or incomplete. (2) In diaphragmatic hernia the mottled appearance of lung tissue is visible through the gas contained in the stomach. This is not noted in elevation of the diaphragm even after extreme distention. These two observations are the most important ones in the radiographic differential diagnosis. If two curved shadows be present a radiographic or fluoroscopic examination after distention of the stomach should indicate which line is stomach and which diaphragm; if the lower line be stomach it will move up against the diaphragm line, and the pyloric end of the stomach will then unfold; if the upper line be stomach, distention upward into the chest will be almost unlimited. If the bow line shadow represent both diaphragm and stomach, distention will cause merely the above-mentioned unfolding of the pars pylorica.

The passage of stomach tube or lead bougie with subsequent radiogram does not seem to have yielded much additional information. Estimation of the intragastric pressure during inspiration and expiration in the two conditions has been attempted, but the results are not clear.

A series of X-ray plates following a bismuth meal should add some confirmatory evidence. The stomach may thus be identified as an organ lying in high position. The colon is almost always included in a hernia, and a plate showing bismuth in the colon above the level of the bow line in the chest would be conclusive evidence of a diaphragmatic rupture. As

far as I have been able to learn, this point has not been emphasized in the literature, but *a priori* it would seem true.

Fluoroscopic examination is useful in studying the movements of the shadow line. The excursion of the diaphragm line in elevation approaches in character the normal. On the other hand, congenital hypoplasia of the left lung is usually present with elevation of the diaphragm and consequently the movements of the diaphragm line may be far from normal. Indeed, a diaphragm shadow may not move with respiration in elevation and a stomach line may move in hernia. A "paradoxical expiratory displacement" has been noted in diaphragmatic hernia. During forced inspiration the right diaphragm descends normally, while the boundary line in the left chest ascends. During forced expiration the right diaphragm ascends while the boundary line on the left descends. Upon forced expiration by contraction of the abdominal muscles the shadow line on the left is again forced high into the chest. The movements on the left occur a little later than those on the right. This phenomenon has not been described in unilateral elevation in which the movements of the shadow line are likely to approach the normal in character, though they are less free in excursion. (See Becker's article, p. 186 *et seq.*).

The diagnosis then of diaphragmatic hernia from elevation of the diaphragm may, at times, be very difficult and may require all of our technical resources. It is quite likely that *rudimentary elevation* is more common than at present suspected and the condition should be more carefully looked for by clinicians.

The differential diagnosis of *pneumothorax* and diaphragmatic hernia is discussed in articles by LeConte and Ingalls. Particularly may there be difficulty when the pneumothorax is the result of injury. Dyspnœa may be present, and severe pain be experienced. The note over the left chest may be tympanitic, and tinkling sounds be heard. The tympany, however, is likely to extend to the top of the lung, and the breath sounds may be amphoric, vague, faint, or absent. In diaphragmatic hernia breath sounds and vocal fremitus

are not generally diminished, and the metallic sounds are associated with peristalsis rather than respiration. The positive coin test is more constant in pneumothorax. Vomiting is likely to be less continuous. Bulging of the interspaces upon closure of the glottis may outline the lower limit of the lung. The radiogram will generally furnish conclusive evidence of an unbroken diaphragm line. Pneumothorax has protean characteristics, however, and diaphragmatic hernia should always be considered before a diagnosis of pneumothorax is made.

Pneumothorax from rupture of the stomach in congenital diaphragmatic hernia with no history of injury has been reported. Such a condition might possibly be suspected after very careful consideration, but it is difficult to see how a diagnosis could be established.

Hydropneumothorax should be less difficult of diagnosis, especially if fluid be present in a moderately large amount. If succussion be obtained, it must be determined that it is produced in the pleura and not in the stomach. A movable line of dulness with signs of pneumothorax and a horizontal fluid line in the radiogram would be conclusive. Leucocytosis and symptoms of pus infection in addition to the findings described above would point to *pyopneumothorax*. Exploratory puncture would be conclusive.

Temporary elevation of the diaphragm has been reported. It has been thought to be the result of an affection of the phrenic nerve. In time the diaphragm line resumes its normal position.

A large cavity in the lower lobe may give metallic sounds and dyspnœic symptoms. The cavity may develop suddenly after the expectoration of large amounts of sputum. The radiogram would show evidence of lung involvement elsewhere, and it should be possible to recognize the diaphragm line.

The name *subdiaphragmatic pyopneumothorax* has been given to the condition in which a pus cavity beneath the diaphragm contains gas. The most common cause is perforating ulcer of the stomach or duodenum. The diaphragm may be

elevated as high as the third rib. There may be tympanitic resonance over the area of the cavity. Metallic tinkle, succussion splash, and coin sound may be present. The chief difficulty would be in differentiation from pyopneumothorax. A history pointing to pre-existent abdominal disease and radiographic findings of elevation of the diaphragm should differentiate the condition.

In the case reported herewith, recurrent colic would have suggested *gall-bladder disease* or other abdominal lesion had a history of trauma not been obtained or had the findings on physical examination of the left thorax been less definite.

Pyloric stenosis has occurred from mechanical conditions in congenital diaphragmatic hernia, and the predominance of gastric symptoms has led to a suspicion of *ulcer. Œsophageal stenosis* may be caused by acute hernia.

Four cases of diaphragmatic hernia have been operated upon at St. Mary's Hospital (Mayo Clinic). Three of these were reported in 1909 by Beckman. The case seen since then was diagnosed from the history and clinical findings by the writer and independently from a study of the radiograms by Selby.

L. J. (a55100), male, aged twenty years. Consultation June 26, 1911. Patient had been caught, together with four other men, two of whom were killed, in a sand slide one year previously; he was instantly and forcibly doubled up with his head between his feet, was unconscious for five to ten minutes, but easily revived. The stomach was empty at the time of the accident. He experienced no pain for a half hour after the injury. Then pain over the entire abdomen and chest became severe; shortness of breath was a prominent symptom, complaint gradually localizing to the upper abdomen and left side of chest and continuing together with some shortness of breath for two weeks. The patient remained in bed for five weeks. Pain across the lumbar region was also complained of, and the patient could not draw his legs up as he lay in bed for two weeks. Bladder and bowel control was good. He was able to walk in ten weeks. After this at times he complained of "sticking" pains across the abdomen and in the left side of the chest, and a sensation of the "stomach being lifted up under the chest." During the year which elapsed between the time of injury and the examination,

the patient had had attacks of severe epigastric pain lasting for an hour or two, with much bloating, sour eructation, and nausea, but no vomiting nor symptoms of intestinal obstruction. Pain often began in the right lower abdomen and later localized in the upper abdomen and left side of the chest. Soda gave some relief, but food did not. These attacks came at any time without relation to food and recurred every few weeks. There had been ten pounds loss of weight. Because of these attacks he consulted a physician. The family history and personal history were negative.

On physical examination a dull tympany was noted over the left side of the chest downward from the level of the sixth spine behind and anteriorly to the midaxillary line. Expansion did not seem to be markedly affected. Vocal fremitus was present over this area, though slightly diminished. The breath sounds could be heard, but were quite distant. Tinkling sounds could also be heard, and these were close to the ear and seemed to occur with peristalsis. Anteriorly from the midaxillary line the percussion note was quite dull, so that the left border of the heart could not be outlined. Heart dulness, however, extended three inches to the right of the midsternal line. Above the second rib in front and the spine of the scapula behind the percussion note was hyper-resonant and breath sounds harsh. The right lung seemed normal.

The X-ray prints, together with their descriptions, by J. H. Selby, will explain the condition found. It is necessary only to point out that the diagnosis from the radiograms was made chiefly from (1) the fact that the bow line in the left chest did not conform in outline to the dome shape maintained in elevation of the diaphragm, and was irregular and indefinite, particularly at its outer portion; and (2) the fact that lung tissue could be seen through the gas bubble below this line, which is not observed in elevation.

Operation July 5, 1911: An oval-shaped opening in the left half of the diaphragm, near the crux, large enough to admit the hand easily, was found. The hernia contained stomach, large intestine, spleen, small intestine, and the tail of the pancreas. (The presence of spleen probably explains the dulness found anteriorly on percussion of the chest.) The lung was completely collapsed. The stomach was distended and its walls were hypertrophied, doubtless as the result of mechanical obstruction. Nearly all of the transverse colon and 12 feet of the jejunum were

in the chest. The spleen was twice the normal size and most difficult to reduce. It was torn and required catgut sutures. Tremendous traction was exerted by the chest cavity so that the stomach and spleen showed a marked tendency to be drawn back into it. The opening into the pleural cavity was sutured with heavy linen for three or four stitches, then interrupted sutures were placed. The suture line was five inches long. The posterior margin of the opening was difficult to catch, the anterior quite easy. Additional sutures were placed where there was evidence of air aspiration along the suture line.

It is impossible to determine what portion of the abdominal contents became a part of the hernia as the result of opening the abdomen. In view of the evidence of decided negative pressure in the chest upon the attempt at reduction of the hernia, it seems likely that the original hernia was increased in size by the additional pressure from below. The lung was found more nearly collapsed at operation than one would have expected from the extent of visible lung tissue in the radiograms.

Four days after operation the patient was quite comfortable and easily examined. The temperature was nearly normal. There were no signs of fluid. Over almost the entire left chest the percussion note was exceedingly resonant, tympanitic, and so drum-like that it approached the quality of a musical tone. Vocal fremitus could be felt with difficulty and breath sounds were distantly transmitted. The heart remained displaced. A pneumothorax was evidently present. One week later there was some change in the percussion note. It continued, however, to be drum-like and very resonant. Breath sounds could be heard a little closer to the ear save at the extreme left base. Cardiac dulness was almost normal in outline. The patient left the hospital on the thirteenth day. He was examined repeatedly up to the time of his discharge six and one-half weeks after operation. No complications developed. The lower portion of the lung slowly completed its expansion. An X-ray plate taken six and one-half weeks after operation is reproduced. This shows almost completed expansion of lung tissue. The return to the normal is remarkable, when one considers that the lung had been partially collapsed for one year. The patient is at present enjoying excellent health.

On recapitulation then it is seen that a history of severe trauma, followed by upper abdominal and left thoracic pains.

dyspnœa, and vomiting, together with physical findings pointing to displacement of the stomach or intestine into the lower left chest and of the heart to the right, will ordinarily be sufficient for making a diagnosis of diaphragmatic hernia. If the history and findings be definite, this will be true whether the patient is seen immediately after injury or some time later. Röntgen ray findings will then be mostly of corroborative value. When, however, the injury has been less severe and the symptoms and signs less definite, and again in most cases of congenital diaphragmatic hernia, radiographic and fluoroscopic examinations must be relied upon for a differentiation of the condition. In interpreting the plates (1) a destruction of the definite dome shape characteristic of the normal diaphragm line, (2) the appearance of lung tissue through the gas bubble in the left chest, and (3) the demonstration of bismuth in the colon above the level of the bow line of the chest constitute the most important evidence in favor of hernia of the diaphragm. By fluoroscopic examination the "paradoxical respiratory phenomenon" may be demonstrated.

REFERENCES.[1]

Becker: Röntgenuntersuchungen bei Hernia und Eventratio diaphragmatica. **Fortschritte auf dem Gebiete der Röntgenstrahlen**, Bd. xvii, 1911, pp. 183–194.

Bechman: Diaphragmatic Hernia, Surg., Gyn. and Obst., 1909, pp. 154–156.

Beltz: Ein Beitrag zur Differentialdiagnose zwischen Hernia und Eventratio Diaphragmatica, München. med. Woch., 1910, lxii, pp. 1006–1009.

Königer: Zur Differentialdiagnose der Zwerchfellhernie und des einseitigen idiopathischen Zwerchfellhochstandes (infolge von Zwerchfell-Atrophie), München. med. Woch., 1909, lvi, pp. 282–285.

LeConte: Rupture of the Lung without Costal Injury, ANNALS OF SURGERY, 1908, xlvii, pp. 383–389.

Ingalls: The Diagnosis of Diaphragmatic Hernia, Jr. A. M. A., 1901, xxxvi, pp. 1770–1774.

Sailer and Rhein: Eventration of the Diaphragm, with a Report of a Case, Am. Jr. Med. Sci., 1905, cxxix, pp. 688–705.

Strüppler: Uber den physikalischen Befund und die neuren physikal. Hilfsmittel bei der Diagnose Zwerchfellhernie. Deutsch. Arch. f. klin. Med., 1901, Bd. lxx, S. 1.

[1] The writer has collected a bibliography of 187 references. This will be furnished to any one particularly interested in a study of the condition.

MANAGEMENT OF THE OPENING IN THE TRANSVERSE MESOCOLON IN COMPLETING THE OPERATION FOR POSTERIOR GASTROJEJUNOSTOMY.

BY WILLIAM J. MAYO, M.D.,

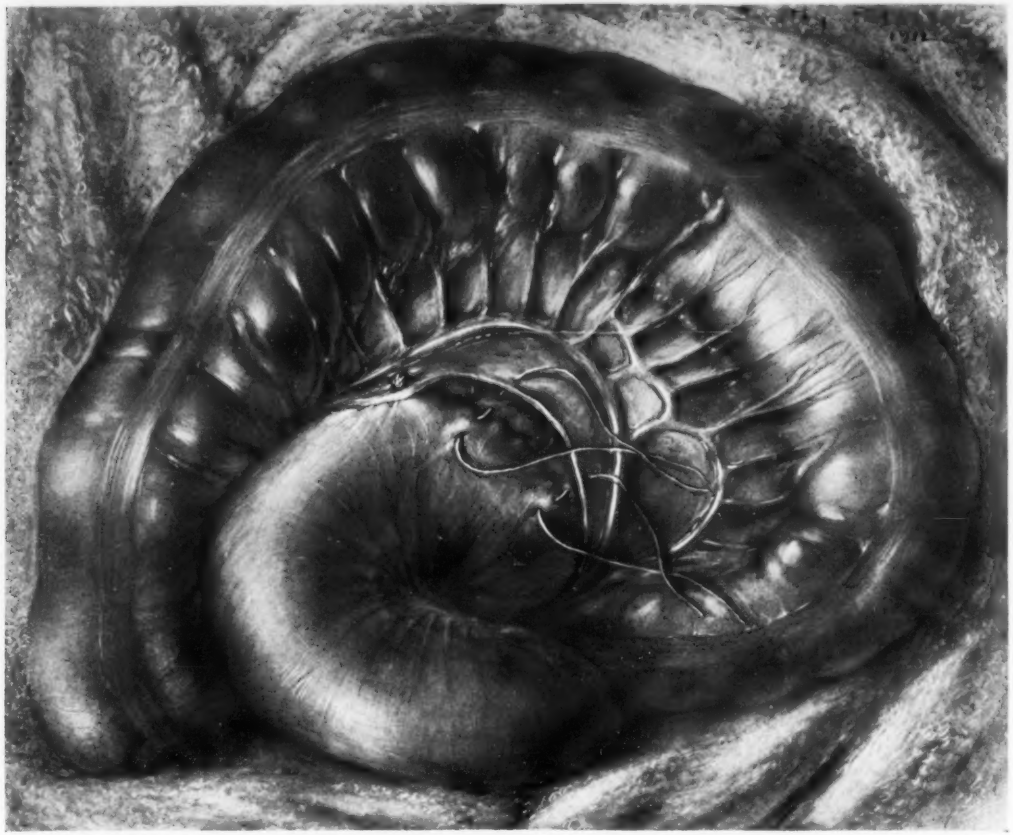
OF ROCHESTER, MINNESOTA.

THE opening made in the transverse mesocolon through which the stomach is brought out posteriorly in the operation of gastrojejunostomy was originally closed by fastening the torn margins with several sutures to the posterior wall of the stomach at some little distance (one-half to one inch) from the gastro-intestinal anastomosis. Later these sutures were omitted because they were thought to be unnecessary. In our experience the omission proved to be unfortunate, since in one case six feet of small intestine herniated through the opening into the lesser cavity of the peritoneum, and on the twelfth day a second operation was required for the relief of intestinal obstruction.

It has been advised by some authorities to suture the margins of the opening to the jejunum just beyond the gastro-intestinal anastomosis, and this plan is practised by a few careful surgeons, although several cases of obstruction have been reported as resulting from it. For some years [1] when performing this operation we have turned the margins of the opening underneath and sutured the peritoneum of the lower surface with three or four stitches to the suture line which unites the stomach and jejunum. This technic has proved very satisfactory in our cases. However, we have had two cases in which a fat transverse mesocolon, sutured in this way, caused secondary trouble because of adhesions forming in a collar-like mass around the stoma, and cure was not obtained in either case until a second operation was performed

[1] Mayo: ANNALS OF SURGERY, November, 1905.

FIG. 1.



Thin transverse mesocolon sutured to the suture line in gastrojejunostomy.

FIG. 2.

Fat transverse mesocolon sutured to the stomach.

in which the margins of the transverse mesocolon were dissected free and united to the stomach at a distance of an inch from the suture line of the gastrojejunostomy.

Fastening the margins of the opening in the transverse mesocolon to the gastrojejunal suture line by several sutures and neatly tucking the edges underneath so there will be no raw surface to become adherent (Fig. 1) is an excellent practice and suitable in the large majority of cases. In the occasional case, however, in which the transverse mesocolon is quite fat, there is danger that adhesions will form, and this technic should not be adopted in these cases, but rather the old method of suturing to the posterior wall of the stomach three-fourths of an inch away from the gastro-intestinal anastomosing suture line (Fig. 2).

SARCOMA OF THE SMALL INTESTINE.

BY JOHN DOUGLAS, M.D.,

OF NEW YORK

Visiting Surgeon, Bellevue Hospital; Assistant Surgeon, St. Luke's Hospital.

MALIGNANT growths of the large intestine are unfortunately comparatively common, carcinoma being the type of growth in the vast majority of cases, Mayo,[1] in a report of 100 resections of the large intestine, 61 for malignancy, only reporting one case of sarcoma. In the small intestine malignant growths are less frequent, and sarcoma in its various forms is by far the most usual type of growth. Kanzler[2] in 1906 could only find 23 published cases of carcinoma of the jejunum or ileum, to which he added two of his own. Primary sarcoma of the small intestine, however, is sufficiently unusual to make the following case worthy of report.

M. C., male, age twenty, native of Turkey. His family and previous history were negative. Six weeks before his admission to Bellevue Hospital on July 1, 1911, he noticed a mass in the lower part of the abdomen. It gave him an uncomfortable feeling when he was up and about, but the pain disappeared on lying down. Tumor grew larger and pain became worse, and he was obliged to stop work three days before admission to the hospital, because of weakness and discomfort. No urinary symptoms.

Physical examination showed a well-developed, anæmic looking but not emaciated patient. The abdomen was somewhat distended but not rigid, and there was no evidence of free fluid. In the median line and slightly to the right of it, midway between the umbilicus and the symphysis pubis, could be felt a firm mass about the size of the fist. It was somewhat irregular in outline and very slightly movable.

A median abdominal incision 12 cm. long was made over the mass, and on opening the peritoneum, an irregular white tumor involving a coil of the ileum and the glands in the mesen-

FIG. 1.

Sarcoma of small intestine, showing specimen removed at operation.

tery of the intestine at this situation was demonstrated. The tumor was adherent to the omentum and slightly to the peritoneal coat of the bladder, and in attempting to free and deliver the mass, the lumen of the intestine, the wall of which was apparently replaced by tumor tissue, was broken into. The tumor with at least 5 cm. of normal intestine on each side of the growth, in all about 45 cm., was resected and a lateral anastomosis performed. The wound was closed without drainage. The bowels moved without catharsis or enemata the day following operation, and except for a slight infection in the lower angle of the wound, due probably to contamination when the intestine was broken into, convalescence was uneventful. In the three months following the operation the patient had gained 22 pounds in weight. The pathological report showed lymphosarcoma.

The most complete report and analysis of cases of sarcoma of the small intestine are those of Moynihan,[3] who gives brief reports of 40 cases submitted to operation up to 1906; and of Lecène[4] (1907), whose article is the most exhaustive on the subject, and includes an analysis of 89 cases, both operative and non-operative. Since these statistics have been assembled, additional cases have been reported by Barling,[5] McGlinn,[6] Erdmann,[7] Anderson,[8] Stern,[9] and Goebel,[10] each one case, while Bondareff[11] reports two cases, LeRoy[12] reports three cases, one a case in which resection was performed, one case found at autopsy, and one occurring in a tuberculous woman. Munk[13] reports six cases of sarcoma of the small intestine and one of the splenic flexure from the Breslau clinic between 1900 and 1908. In addition to these cases reported as sarcoma Fletcher[14] reports a case of primary lymphadenoma and Scudder[15] one of malignant lymphoma or lymphosarcoma of the small intestine for which resections were performed.

Pathology.—Round-cell sarcoma occurs in about half the total number of cases reported, spindle-cell and lymphosarcoma are the next most frequent varieties, while myosarcoma, alveolar sarcoma, fibrosarcoma, giant-cell sarcoma, myxosarcoma, and angiosarcoma are also reported. Lecène divides the cases into two kinds, circumscribed and diffuse, single tumors occur-

ring twice as frequently as multiple growths. Ulceration occurs in over half the cases, but cicatricial contraction, such as occurs in carcinoma of the intestine, causing stenosis and obstruction, is very unusual. The ileum is the most frequent site of the tumor, the jejunum, ileocæcal region, and junction of the duodenum and jejunum being involved in the frequency of the order given. The mesenteric glands are involved early in the course of the disease. Perforation of the intestine may occur.

Symptoms.—The first symptom noticed is usually the presence of the tumor in the abdomen or abdominal pains or discomfort. There may be some abdominal distention, but complete obstruction is rare. When obstruction occurs it is usually due to growths in the mesentery or to kinks or adhesions of the intestine. A small tumor may be the cause of an intussusception, which latter condition is not infrequently the first symptom of the growth. Anæmia and cachexia appear quite early, the latter being the usual cause of death. Ascites or malena is rare. There may be some elevation of temperature, but usually not.

Prognosis.—Of course without operation the prognosis is fatal. Lecène gives as the duration of illness four to six months in round-cell and lymphosarcoma; and eight to ten months in spindle-cell sarcoma. The primary mortality from operation is high—57 per cent. in Moynihan's series of 40 cases, five deaths being due to recurrence. The recorded cases since these statistics would lower this mortality. Bondareff states that recurrence occurs in 95 per cent. of the cases of round-cell sarcoma, although he reports one case without recurrence for three years, and Steinthal [16] one free for three and a half years, and a case of spindle-cell sarcoma free for four years after operation.

Statistics, however, as to operative mortality or frequency of recurrence are of little value, as so many elements, such as size, distribution, situation, duration, glandular involvement, and involvement of neighboring structures, are the determining factors.

Treatment.—If the diagnosis is made early enough to com-

pletely remove the growth there is some prospect of a cure, but even if there is prospect of recurrence, the symptoms may be relieved and life prolonged by as complete a resection as possible, well clear of the involved intestine, with the removal of the mesentery and glands, followed by an anastomosis either by the end-to-end or lateral method.

REFERENCES.

[1] Mayo: Trans. of Am. Surg. Assn., vol. xxvii, 1909.
[2] Kanzler: Beiträge zur klin. Chir., Bd. xlviii, Hft. 1.
[3] Moynihan: Abdominal Operations, 1906.
[4] Lecène: Travaux de Chirurgie (Hartmann), Paris, 1907.
[5] Barling: ANNALS OF SURGERY, vol. xlv (1907), p. 242.
[6] McGlinn: N. Y. Med. Jour., Dec. 12, 1908.
[7] Erdmann: ANNALS OF SURGERY, vol. li (1910), p. 122.
[8] Anderson: Brit. Med. Jour., Oct., 1907.
[9] Stern: Berlin. klin. Woch., 1909, No. 37.
[10] Goebel: Zentralbl. der Chir., Bd. 37 (1910), S. 1258.
[11] Bondareff: Chirurgia (Russia), No. 127 (Zentralbl. f. Chir., vol. xxv (1908), p. 86.
[12] LeRoy: Arch. internat. de Chir., vol. iii, Fasc. 2.
[13] Munk: Beiträge zur klin. Chir., Bd. lx, p. 197.
[14] Fletcher: Practitioner, London, Sept., 1909.
[15] Scudder: Surg., Gyn., and Obstetrics, vol. xii (1911), p. 73.
[16] Steinthal: Münch. med. Woch., 1904, p. 751.

INVERSION OF MECKEL'S DIVERTICULUM.

WITH A REPORT OF SIX CASES.

BY HAMILTON DRUMMOND, M.B.,

OF NEWCASTLE-ON-TYNE,

Surgical Registrar, Royal Victoria Infirmary of Newcastle.

Of 78 cases of intussusception of all ages operated upon in the Royal Victoria Infirmary, Newcastle-upon-Tyne, from 1900 to February, 1911, five (6.4 per cent.) were due to inverted Meckel's diverticulum. The notes of these cases, along with one other which occurred in the practice of Dr. Modlin in Monkwearmouth Hospital, form an interesting addition to the already published records.

Gray,[1] with a case of his own, collected 40 cases, and it is now generally recognized that the condition is more common than was formerly supposed.

At the Summer Pathological Meeting of the Northern Division of the British Medical Association, 1910, I showed a series of Meckel's diverticula, some removed by operation and others found in the post-mortem room, and called attention to the different types met with and to the dangers attending their presence. For example, a persistent Meckel adherent to the umbilicus by a cord may either give rise to a secondary volvulus of the loop of small intestine from which it arises, or, acting as a band, may produce intestinal obstruction. Again, a Meckel of unusual length (6 in. or 8 in.) rarely exists throughout life without becoming adherent to some point in the intestinal tract and thus exposing the individual to obstruction or strangulation. Several cases of the kind have come under my own notice, and in some a persistent Meckel's diverticulum was found to be the seat of an acute inflammation which gave rise to gangrene.

The clinical picture in the cases where the intestinal obstruction is not marked may closely simulate that of acute

appendicitis, with or without abscess; and where the mass or tenderness is not in the appendix area, an acute Meckel's diverticulitis should always be taken into consideration in the diagnosis.

A Meckel's diverticulum with a narrow neck may encourage and harbor calculi which give rise to attacks of pain like gall-stones or appendicitis, the pain being due to the forcible contraction of the unstriped muscular tissue in the diverticulum in its effort to expel the calculi, as in a case reported by Sherren.[2] Here a fold of mucous membrane narrowed the lumen near the proximal end of the diverticulum, which was packed with calculi. In this case a diagnosis of appendicitis was made.

A case was recently reported by Albert Martin[3] where a Meckel's diverticulum with a narrow neck contained a calculus the size of a horse bean. The end of the diverticulum was completely gangrenous and lay in an abscess cavity. There was also definite intestinal obstruction.

Another rare pathological entity arising from the remnants of the umbilical duct is referred to by Eisendrath.[4] There is neither a communication with the bowel nor at the distal end with the umbilicus, but the intermediate portion, as a result of its own pent-up secretion, forms an enterocyst which may give rise to a large tumor analogous to a hydrops of the gall-bladder due to a calculus impacted in the cystic duct.

A small Meckel's diverticulum unattached at its peripheral end, with a broad base and a narrow apex, is the type most likely to become inverted into the intestine and cause intussusception of the ileum, and it is to this type that I wish specially to draw attention.

Case I.—P. M., a boy aged five years, was admitted to the Royal Infirmary, Newcastle-upon-Tyne, on June 6, 1901, under the care of Prof. Rutherford Morison. He was perfectly well until the previous day, when he was seized while at school with severe pain in the abdomen and shortly afterward vomited. On

reaching home the bowels moved, but the pain persisted and came on in spasms every few minutes. He passed blood by the rectum and during the evening the spasms became less frequent and he occasionally slept. Vomiting persisted up to the time of his admission.

On the following day when admitted to the hospital his general condition was good. A sausage-shaped tumor could be felt in the right iliac fossa, but nothing abnormal by the rectum.

Professor Morison opened the abdomen over the tumor by a small oblique muscle-cutting incision in the right iliac fossa, and clear free fluid escaped. An intussusception (about 6 in. in length) involving the small bowel only was delivered, and reduction was effected without much difficulty. When this had been done a hole in the side of the gut was noticed, and something firm, subsequently found to be an inverted Meckel's diverticulum, was felt in the bowel just beyond this point. A small incision was then made at the margin of the Meckel in the long axis of the bowel and the diverticulum was everted. It was then excised and the wound in the ileum sutured transversely by Lembert sutures and the abdomen closed in layers of catgut. The wound was found to be healed on the ninth day after operation, when the skin sutures of silkworm gut were removed; the patient caused no anxiety after operation.

The specimen is a small Meckel's diverticulum which in the recent state was 1½ inches in length and cone-shaped, with the broad end toward the bowel.

CASE II.—E. S., a youth aged fifteen, was admitted to the Monkwearmouth Hospital under the care of Dr. Modlin on July 6, 1904. While going about four days previously he had an attack of pain in the lower part of the abdomen. Shortly afterward he vomited and continued to be sick throughout the day.

On the following day he felt better and the bowels were moved, but at 7 P.M. he was again seized with severe pain and vomiting, which persisted until next morning, when he again had relief which continued until early in the morning of the day of admission. About 2 A.M. of that day the pain returned and persisted up to 6 A.M. On admission, about 8 A.M., he looked ill and complained of slight pain about the umbilicus. There was slight distention of the abdomen. No tumor was palpable, but he was more tender on the left side than on the right; there was no dulness in the flanks.

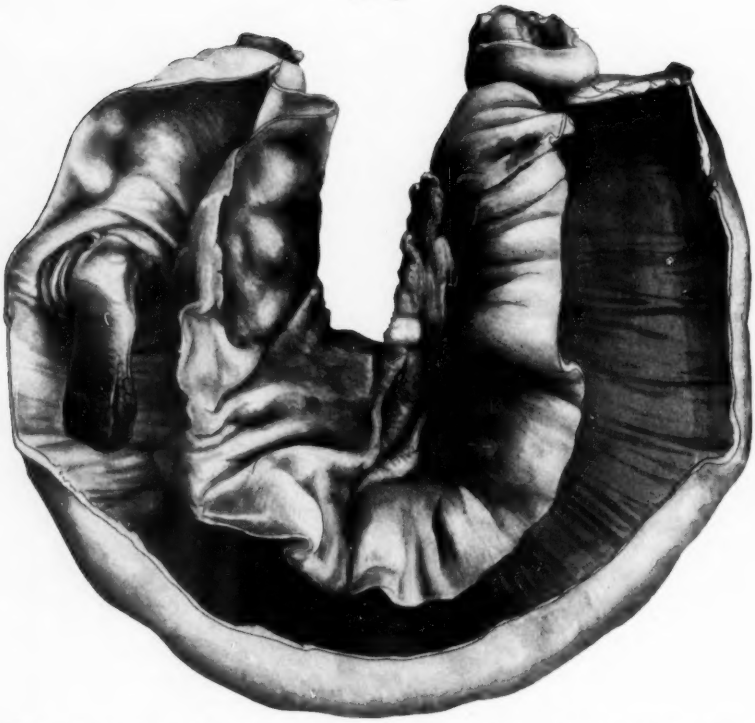
FIG. 1.

Meckel's diverticulum forming the apex of the intussusception.

FIG. 2.

The Meckel's diverticulum and intussusception are seen reduced.

FIG. 3.



The intussusception has been reduced but the Meckel's diverticulum is still lying in the bowel.

An enema given shortly after was without effect.

On opening the abdomen Dr. Modlin found an intussusception of small bowel into small bowel lying to the left side of the umbilicus. Attempts at reduction were of no avail as the layers of gut were so adherent, and a resection was done with end-to-end anastomosis. The patient died shortly afterward.

The specimen (Fig. 1), which had been hardened in formalin, was on examination found to consist (without reduction of the intussusception) of 22 inches of small intestine; and on removal of the bowel over the apex of the intussusception, the distal end of an inverted Meckel's diverticulum was seen. The diverticulum and the ensheathing layer of small intestine surrounding it were completely gangrenous and the œdematous mucous membrane stripped readily from its walls. The length of the diverticulum was 4½ inches; it was distended at both ends and narrow in the intermediate portion.

Case III.—C. S., a man aged twenty-five, a bricklayer, was admitted into the Royal Victoria Infirmary, Newcastle-upon-Tyne, under the care of Mr. Angus on November 21, 1908, with the history that on the morning of November 18 (three days before), while at work, he was seized with a severe pain in his belly after taking a drink of water. With the desire to defecate, his bowels were well moved, and about one hour later he vomited. The pain persisted and he continued to vomit at intervals up to the time of admission. The day before admission the pain came on intermittently and was accompanied by rumblings.

He stated that he had suffered from attacks of abdominal pain a few months previously which were always relieved when his bowels were moved.

On admission he looked ill; the pulse was 40, temperature 97.6°, respirations 80; his tongue was dry and he was vomiting dark, bile-stained fluid. He stated he had not had his bowels moved the first day of his illness and had not passed flatus.

The abdomen was not distended but rather slightly retracted. The whole wall was somewhat rigid and there was tenderness on pressure in the epigastrium.

A diagnosis of intestinal obstruction involving the small intestine was made and immediate operative interference was decided upon.

Mr. Angus opened the abdomen by a vertical incision in the

middle line reaching above and below the umbilicus. The small intestines were acutely congested and distended, and protruded into the wound. An intussusception, almost gangrenous, lay close to the cæcum. Attempts to reduce the bowel were unsuccessful, so the gut was resected, the ends being closed and a lateral anastomosis made between the small intestine and cæcum with a Murphy button. The abdomen was closed in layers of chromic gut and silkworm sutures for skin.

The patient bore the operation well and made an uninterrupted recovery. The button was passed on the seventh day after operation and he left the hospital healed and well on December 11, 1908.

Specimen shows about 6 inches of intestine without reduction of the intussusception, the apex of which is formed by Meckel's diverticulum. On reduction there is altogether about 12 inches of the bowel.

The Meckel was plum-colored and showed commencing gangrene most marked at its terminal end. The whole was completely inverted into the bowel and on reduction was about 4 inches in length.

Case IV.—E. W., aged eleven, schoolboy, was admitted into Prof. Rutherford Morison's clinic in the Royal Victoria Infirmary on the evening of March 12, 1909. It was stated that he went to bed quite well three days before admission, but shortly after complained of sudden pain in the epigastrium and later vomited. The vomiting continued right up to the time of admission. The bowels had not been moved for two days.

On admission he looked very ill, his temperature was 128°, and his tongue was dry. His peripheral circulation was extremely bad.

The abdomen was markedly distended, tympanitic, and tender.

Rectal examination discovered a tumor in front of the rectum, which appeared to be fixed in the pelvis. There was no note of blood on the finger.

About one hour after admission Mr. Richardson opened the abdomen in the middle line below the umbilicus. Some free fluid was present in the peritoneal cavity. The small intestine was much distended and red. The pelvis was filled by an intussusception of small intestine into small intestine. The mass was gangrenous and irreducible and was about 7 inches in length.

The bowel was resected and a lateral anastomosis by simple suture performed.

After reducing the eviscerated intestine into the abdomen, the belly was closed in layers. The boy stood the operation badly and died shortly afterward.

In this case a definite intucking of the umbilicus was observed, but not until after death.

The specimen showed a gangrenous intussusception which, when reduced, measured 18 inches in length. Forming the apex was a small Meckel's diverticulum in the recent state about 1½ inches in length, which had become completely inverted into the lumen of the bowel, and it, like the surrounding intestine, was completely gangrenous. The diverticulum sprang from the anti-mesenteric border and was distinctly cone-shaped, with the broad end forming its base.

Description of Specimen (Fig. 2).—The intussusception, which was reduced and everted prior to hardening in formalin, consisted of a loop of small intestine measuring 18 inches in length. The first 3 inches were normal in size and color, but directly below this point from the origin of the diverticulum the bowel was distended, œdematous, and plum-colored for 12 inches. The gangrene was most marked around the diverticulum, the terminal 6 inches gradually being more normal in appearance. The gangrenous Meckel's diverticulum sprang from the anti-mesenteric border. It measured 1½ inches in length and, as will be seen from the accompanying drawing, was distinctly cone-shaped with the broad base toward the bowel; the circumference of the base was 2¾ inches. It was inverted into the bowel.

The peritoneal coat of the involved bowel was extensively ruptured on both sides, and the muscular fibres were plainly seen where the serous membrane had given way. No sign of any mesentery or vessels running from the bowel to the diverticulum were seen, the latter probably being rendered invisible by the œdematous condition of the peritoneal coat.

On inspection of the diverticulum from within, the broad base was found to be nearly occluded by œdematous mucosa which had become separated throughout nearly the whole of its length, the only firmly attached portion being that in relation with its apex. The small intestine immediately above the diverticulum showed a well-marked fold of mucous membrane extending round the greater part of the lumen of the bowel not unlike a valve of Houston in the rectum. A similar condition was found in Case VI.

Case V.—W. J., aged three, female, was admitted under the care of Mr. Martin in the Royal Victoria Infirmary on November 9, 1910.

The present attack began one week previously. While playing

two hours after breakfast she was seized suddenly with a severe pain in the abdomen about the umbilicus and vomited shortly afterward. She remained in bed for three days, refusing any solid food and complaining of pain in the stomach. On the following day she became much worse. The pain came on in paroxysms and the vomiting continued up to the time of admission. The bowels were slightly moved at the commencement of the illness, but during the last two days prior to admission no flatus or fæces had been passed.

The mother stated that the patient had previously had similar attacks, which were always relieved by emptying the lower bowel with simple enemata and a dose of castor oil by the mouth.

The first attack was noticed in January, 1910, and they had persisted right up to the time of admission, coming on about every six weeks. The pain was said to be cramping in character and at times most severe, causing her to cry out. She had never passed blood per rectum. As a rule the attacks came on after she had gone to bed.

On admission, the child was well nourished but looked ill and in a lethargic condition. Pulse 126; temperature 99.8°; tongue dry and brown.

Abdomen: There was some distention in the upper part. Marked peristaltic movements were plainly seen in the region of the umbilicus on the right side.

The umbilicus itself was distinctly indrawn.

There was no rigidity of either rectus muscle and no tumor could be felt.

A rectal examination gave no further information. There was no blood on the examiner's finger.

Operation: Mr. Martin opened the abdomen in the middle line above the umbilicus. Distended loops of small intestine protruded into the wound, and on pushing these aside a tumor was found in the right hypochondriac region. On further examination this was found to be an intussusception, the apex of which reached as far as the middle of the transverse colon. It was easily reduced, and the bowel was in good condition except at one point where an inverted diverticulum arose from the antimesenteric border of the gut and formed the apex of the intussusception.

The diverticulum was reduced and excised, and the hole in the intestine was closed by a purse-string suture of silk and the

abdomen was closed in layers of catgut. The child died twelve hours after the operation.

An examination of the specimen, which in the recent state was 1¼ inches in length, showed it to be cone-shaped with the broad end toward the bowel. The apex of the diverticulum contained a tumor, the size of a small hazel-nut, which on section proved to be an accessory pancreas. Section of the bowel wall at the base of the diverticulum when microscoped showed that it contained all the intestinal coats.

CASE VI.—Wm. L., aged twenty-nine, married, a brass polisher, was admitted into the Royal Victoria Infirmary in July, 1909, for hæmoptysis. After a short stay in the hospital he left for the seaside, but soon returned under the care of Mr. Angus, complaining of colicky pains in the abdomen. The griping pain was sometimes very severe and extended from the epigastrium over to the left hypochondriac region.

He went back to work in August, 1909, and except for the griping pains remained in good health until November, 1910.

On December 3 of that year he was readmitted with a recurrence of hæmoptysis, having had two attacks within three weeks.

On admission, he was a well-nourished, healthy-looking man. Temperature normal, pulse 88, and tongue clean. He stated that his bowels were usually constipated and that he required frequent purgatives.

Examination of the chest showed signs of early mischief below the left clavicle. The abdomen was normal.

On December 26 and 28 he had hæmoptysis and on December 31 he had an attack of abdominal pain and was observed to be slightly tender and distended in the epigastrium. The hæmoptysis recurred again on January 10 and January 19.

On January 25, while in bed, he complained of cramping pains in the abdomen and felt very ill. He vomited incessantly until 3 A.M. on the following day, when blood was noticed in the vomit. Shortly after the bowels were moved by enema and he felt much better.

On February 4, after tea, he was again seized with a sudden pain in the epigastrium, which made him vomit and roll about. On examination, a mass, which increased in size and became harder when he complained of pain, was felt in the lower part of the abdomen. The bowels were moved and he passed about one pint of bright red blood per rectum.

As his condition did not improve, Mr. Angus opened the abdomen by a median laparotomy on February 6. In the right lower abdomen was found an intussusception of the enteric type, the lower end of which was about 4 inches from the ileocæcal valve. On attempting to reduce the intussusception the bowel wall was split in several places through its peritoneal coat, otherwise the reduction was completed without difficulty. There was some free fluid present.

On palpating the bowel which had intussuscepted a lump was felt within the lumen running from a puckered depression on the anti-mesenteric border of the ileum. The loop of bowel was therefore resected, the ends being closed by Lembert sutures of linen thread, while a lateral anastomosis was performed by simple suture, and the abdomen was closed in layers by catgut.

Patient stood the operation well and continued in a satisfactory condition until February 11, when he complained of a sudden pain in the right side, which was followed shortly after by vomiting.

On the following day his abdomen was much distended, the pain continued in spasms, his pulse became rapid and small, and he died on February 14, 1911.

Post-mortem examination showed peritonitis limited to the lower abdomen. The anastomosis which was situated about 18 inches from the cæcum was perfectly united, but it was found that a leak had occurred in the free end of the distal closed loop of intestine where a gangrenous patch had perforated from deficient blood supply.

Description of the Specimen.—The resected intestine in the recent state was about 2 feet 6 inches in length (Fig. 3). It showed some dilatation and hypertrophy of its walls, and about the middle of the loop, close to the mesenteric border and extending on to the greater part of the mesentery, was an area of subperitoneal extravasation. The serous coat of the bowel was thickened and had ruptured during the act of reduction at a point adjacent to the extravasation, and it was here that the intestine wall had been sutured.

Apart from this, the specimen showed that neither the mesentery nor the bowel wall was seriously damaged.

The Meckel's diverticulum, which measured 3½ inches in length, is seen in the drawing (the intussusception of the bowel having been reduced). It was slightly club-shaped toward the distal half, which was fuller and measured 2 inches in circumference.

Immediately above the base of the Meckel's diverticulum the mucosa formed a distinct fold which appeared to diminish the size of the lumen of the bowel at this point.

The distal third of the diverticulum showed commencing gangrene, being of a dull plum color, while the remainder looked normal.

Viewed from the peritoneal aspect a portion of well-formed mesentery, in which the vessels were obvious, could be seen protruding from the opening at the point of entrance of the inverted diverticulum; this (mesentery of the Meckel) was continuous with the mesentery of the small bowel.

The entrance of the inverted Meckel easily admitted a fine probe which passed close up to the apex of the diverticulum.

REMARKS.—It should be mentioned that for a Meckel's diverticulum to become completely inverted into the bowel it must be free in the belly cavity. But this is not always the case, as adhesions, which fix the diverticulum to the adjacent small intestine, are apt to form, as is not infrequently found at post-mortem examinations. They naturally prevent inversion taking place and diminish the risks suggested by these cases.

It will be noted that in all six cases here recorded the whole of the diverticulum was inverted, and that there was an accompanying intussusception of the small intestine. The literature shows, however, that this is not always the case. Watson Cheyne [5] points out that in a number of recorded cases the inverted diverticulum had merely been responsible for an acute abdominal attack, leading to either peritonitis, due to strangulation of its blood supply, or to gangrene. In his own case [5] the greater portion of the inverted diverticulum consisted of mucosa, the serous coat at its base being the only portion that had become intussuscepted.

Several views have been suggested to explain the inversion of the Meckel into the small intestine.

Kütner [6] considers this due to peristalsis of the diverticulum, which becomes inverted into the bowel in its efforts to expel its contents.

De Quervain [7] expresses the opinion that a rapid flow of the intestinal contents through the lumen of the small intestine produces a negative pressure in the diverticulum, and thus favors its sudden inversion into the bowel.

My own view is that the occurrence depends upon a chronic inflammatory process affecting the mucosa at the base

of the Meckel, which results in the first instance in swelling of the mucous membrane and prolapse into the lumen of the bowel. This state of matters may account for pain and hemorrhage, and as the prolapsed mucosa increases in size and becomes more and more lax, it hangs into the bowel like a polypus which the intestine attempts to expel, thus leading to inversion.

My contention that the inversion of the diverticulum is due to chronic changes is borne out by the frequent history of previous attacks of hemorrhage and pain (usually cramping in character).

Coffey's[8] case serves as an example of many others recorded, where previous attacks of abdominal pain and rectal hemorrhage have been in existence. He operated upon a boy aged seven, who, at the age of two, had a severe attack of abdominal pain, cramping in character, which persisted for thirty-six hours. Later he had these attacks regularly every two months, and they were always accompanied by blood in the stools; they persisted for four years. After a very bad attack he was operated upon and an intussusception found, the apex of which was formed by a small inverted Meckel's diverticulum which was in the transverse colon. The intussusceptum was resected and the cut lower ends of the ileum were united by simple suture. The child made a good recovery.

Of my cases, Cases III, V, and VI gave a history of previous attacks of abdominal pain, cramping in character. In Cases I, II, and IV no note was made as to this, and unfortunately it has not been possible to trace them.

Though there is no case on record, it seems quite reasonable to suppose that a Meckel may undergo a natural cure by becoming inverted into the bowel and separated by gangrene.

O'Connor[9] reports a case of intussusception due to an inverted Meckel's diverticulum in a boy aged thirteen who, on the fourth day after the attack, passed per rectum 11¼ inches of gangrenous small intestines with a Meckel's diverticulum attached.

Abnormality at the umbilicus is another point which may be valuable in aiding diagnosis.

Treves [10] states that a congenital hernia is not infrequently present with Meckel's diverticulum, and numerous other deformities of the umbilicus are recorded, from a mere tucking-in to a definite fistula.

Bidwell [11] operated upon a case of intussusception of the ileum due to an inverted Meckel's diverticulum in a boy aged three, on whom he had previously operated for a congenital umbilical hernia when the child was one year old.

In Gray's [1] case he observed the umbilicus to be raised and dome-shaped and the overlying skin to be of a bluish tint and considerably scarred.

A somewhat similar condition was observed in Case VI operated upon by Angus. The umbilicus was large and dome-shaped, but discoloration and scarring were absent. In Case V there was pronounced puckering of the umbilicus. A similar condition was found in Case IV, but the sign was not observed until after death. No note was made of the condition of the umbilicus in any of the other cases.

On careful examination of the umbilical cicatrix in post-mortem subjects dead from other causes, I have frequently found the umbilicus either raised or considerably indrawn where Meckel's diverticulum was present, so that without well-marked evidence of intussusception this sign alone is of little value as a point of diagnosis.

The diverticulum removed from Case V is of interest, having at its apex an accessory pancreas.

REFERENCES.

[1] Annals of Surgery, December, 1908.
[2] Royal Society Med., Nov., 1909.
[3] Northd. and Durham Medical Journal, 1910.
[4] Annals of Surgery, 1910.
[5] Annals of Surgery, December, 1904.
[6] Beitrage zur klinischen Chirurgie, vol. xxi, 1898 (quoted by Watson Cheyne).
[7] Centralblatt für Chirurgie, 1898 (quoted by Watson Cheyne).
[8] Annals of Surgery, 1907.
[9] British Med. Jour., 1894.
[10] System of Surgery, vol. ii, p. 727.
[11] Lancet, September, 1907.

PRIMARY SARCOMA OF THE MALE URETHRA.*

REPORT OF A CASE.

BY ERNEST G. MARK, M.D.,

OF KANSAS CITY, MO.

Attending Genito-urinary Surgeon to Kansas City General Hospital.

THE occurrence of sarcoma in the urethra is most unusual, and its appearance as a primary growth in the male urethra is not recorded in the literature. To quote from a monograph by the writer, dealing with new growths of the urethra and presented before the 1908 meeting of this Association:

"To Hoening (*Berlin klin. Wochenschrift,* 1869, page 55) belongs the credit for the first reported case. Rizzoli (*Jour. de med. de Bruxelles,* 1875), Tillaux (*Annals de gynecologie,* 1889), Buttner (*Zeitschrift für Geo. und Gyneak.,* Bd. xviii, page 122), Ehrendorfer (*Centralblatt für Gyneak.,* 1892), Lejars (*Leçons de Chirurgie*), and Albarran have all reported well-authenticated cases of fibrosarcoma. Hall and Frick (*Jour. A. M. A.,* June 23, 1906) record a case of melanotic sarcoma, which they assume from the postmortem findings must have originated in the urethra. The case is unique, but the clinical evidence is well supported.

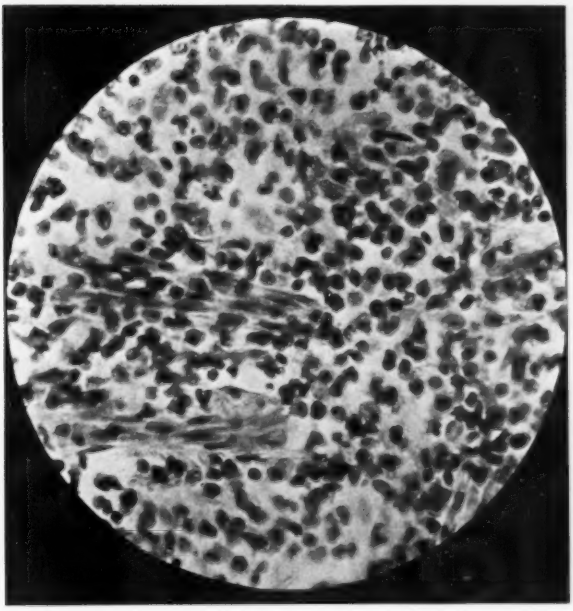
"Legueu makes the statement based on his investigations that sarcoma occurs exclusively in the adult female. In the case reported by Hall and Frick, the patient was a male, thirty-three years of age.

"Fibrosarcoma of the urethra pursue the same indolent course that characterizes their growth in other parts of the body. Their appearance is in no way typical and their clinical differential diagnosis from fibromata is almost impossible."

The case report of the patient observed by the writer follows:

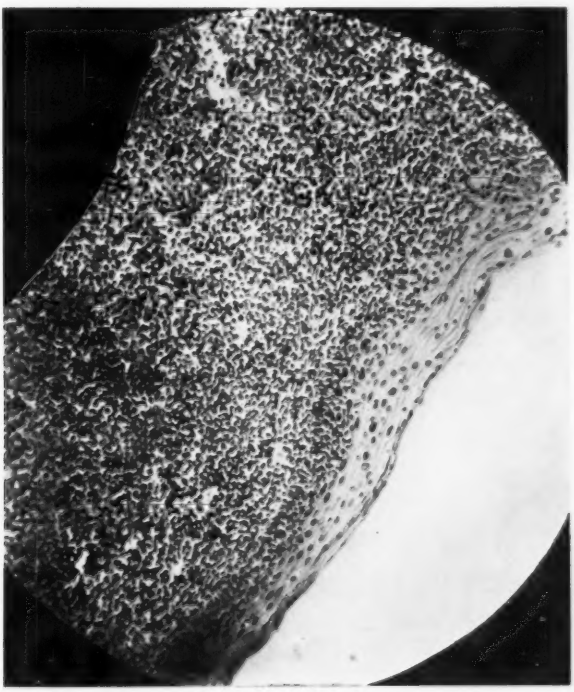
* Read before the 1911 meeting of the American Urological Association.

FIG. 1.



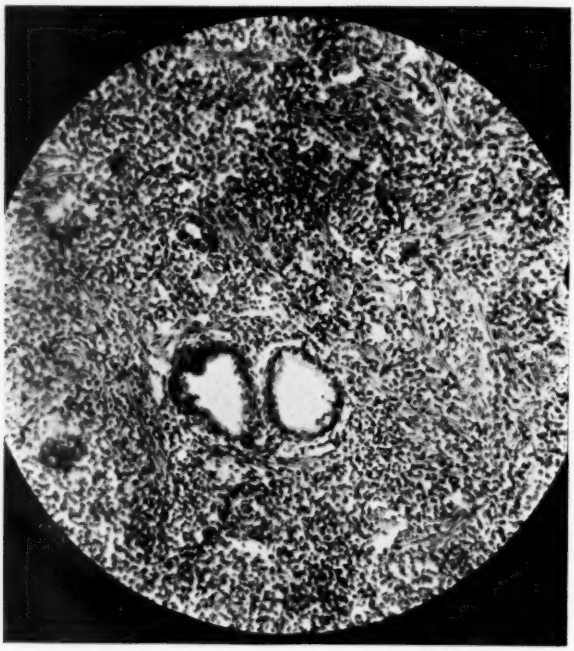
Photomicrograph showing character of tumor cells and connective tissue.

FIG. 2.



Photomicrograph showing relation of tumor cells to urethral epithelium.

FIG. 3.



Photomicrograph showing relation of tumor cells to urethral glands.

FIG. 4.

Photomicrograph showing relation of tumor cells to glands.

C. R., age twenty-four, Hereford, Texas; occupation, automobile mechanic, referred by Dr. J. D. Griffith. Family history negative. Seven or eight years ago, while on a ranch and out of reach of medical attention, he had an attack of what was, apparently from the history given, acute appendicitis followed by a generalized peritonitis, from which he recovered without apparent sequelæ. In March, 1910, he was operated on for an inguinal hernia. For some two or three weeks previous to operation he had noticed a slight burning or smarting in the pendulous portion of the urethra. After operation he was allowed no water to drink for a few days, and micturition caused pronounced burning in the urethra. On palpation of the penis a small lump or hardened, thickened spot was discoverable about one inch posterior to the glans penis in the spongy body. This was diagnosed without urethroscopy as an ulcer in the urethra, and hand injections given. These injections caused the urethra to become inflamed. The thickened portion extended gradually backward. The patient described it as feeling like a ridge getting smaller both proximally and distally. There was very little pain or discomfort except on urination. Up to four or five months before presenting himself for treatment, no obstruction to the stream was noticed. Pollakiuria had been gradually increasing. At the time of entering the hospital there was a very small stream with accompanying dysuria. From the first there had been a serous discharge from the meatus, which gradually increased and became serosanguineous. For about six weeks previous to examination slight terminal hæmaturia was noticed. He had apparently lost none in weight and appeared well nourished.

Examination.—Abdomen negative. Thorax negative. Examination of the genitals revealed a fairly hard elongated mass, palpable from just posterior to the glans back through the scrotal urethra. This mass showed a decided tendency to become turgescent and much harder on handling without accompanying turgescence of the cavernous bodies. A slight serosanguineous discharge presented at the meatus. The scrotum and contents were normal. The prostate was small and showed no evidence of nodulation. Vesicles normal. No. 10 F. bougie a boule was passed with difficulty from the mid-pendulous portion.

Urethroscopy.—No. 24 F. tube met obstruction just posterior to the corona. Under air inflation, very pale polypoid masses, irregular in outline, were observed, springing from the entire urethral circumference. Using the urethroscopic tube as a curette, these masses were removed with great difficulty as far back as the scrotal urethra. On account of the bleeding and the duration of the operative procedure, it was deemed advisable to postpone any further measures. The masses thus removed were left at the hospital for pathological examination, which was somehow neglected. Six days later the work was taken up where it had been left off, and, utilizing the same procedure as at the former operation, the remaining growths or portion of the growth were removed back to the anterior layer of the triangular ligament.

A cystoscope was now introduced without difficulty and examination revealed a high-grade cystitis but no evidence of new growth. The bladder capacity was much diminished.

Suprapubic drainage was instituted and regular soundings done. On account of the pronounced tendency of the growth to recur and the knowledge of its real character this drainage was made permanent. The patient refused radical interference and left the hospital about six weeks later. At the time of leaving the hospital, the growth was rapidly recurring.

The specimens removed were submitted to Dr. Frank J. Hall, whose report follows:

"Gross specimen consists of a number of whitish soft fragments. Section shows sarcoma poor in blood-vessels with small amount of stroma. The cells are of the large round type, with a suggestion of polymorphous cells with vesicular nuclei and pinkish staining cytoplasm. (Frozen section, hæmatoxylin and eosin stain.)"

FIG. 1.

Combined abdominal retractor.

A COMBINATION ABDOMINAL RETRACTOR.

BY DONALD C. BALFOUR, M.B. (Tor.),

OF ROCHESTER, MINNESOTA.

Associate Surgeon to St. Mary's Hospital.

IN describing the retractor, a cut of which is inserted, no claim is made to originality, in that the instrument is essentially a combination of two well-known retractors, each suitably modified.

It has been the practice for many years in the clinic at St. Mary's Hospital to obtain exposure in pelvic work by the use of a spreading retractor of the Simpson type, aided by a hand retractor in the lower end of the incision. Recently lateral retraction has been procured by the self-retaining instrument of Gosset, which accomplishes the same result as the Simpson, but is somewhat more simple of construction, easier of application, and more efficient, inasmuch as it holds its position firmly when introduced.

For about a year we have also used a retractor of the Doyen type in the clinic at St. Mary's Hospital. This retractor is eminently satisfactory so far as pelvic exposure is concerned, but seems unnecessarily cumbersome. The chief objection is not in the retractor itself, but concerns its upright portion between the thighs of the patient, which must be of different sizes for different patients. This change is not easy of accomplishment and renders the technic more complicated.

The obvious usefulness of these two retractors, *i.e.*, the Gosset and the Doyen, rendered evident the desirability of combining the merits of both into a single retractor.

An instrument was therefore made from a special design and, with some slight modification, is in use in this clinic at the present time. Reference to the cut renders a detailed description of the instrument almost unnecessary. The Gosset is changed to obtain a fixed point to hold the middle blade of

the instrument. This is procured by an extra bar on which is a sliding set screw. The Doyen is fitted with a short flat handle about an inch wide and six inches long, with a central open portion throughout the entire length. The application is very simple. After placing the self-retaining portion in the wound with the cross-bars toward the lower end of the incision, the necessary lateral traction is procured by separating the limbs of the instrument. The second part is now placed in the wound and tracted into the lower part of the incision until the desired exposure is obtained, when the screw is clamped, fixing the blade.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 4, 1911.

DR. R. G. LE CONTE, President, in the Chair.

A CHILD WITH RUDIMENTARY LEFT UPPER EXTREMITY (PEROBRACHIUM).

DR. PENN G. SKILLERN, JR., exhibited the patient. He was a male, aged 5 years, the second youngest child of healthy and normal Irish parents. Five brothers and sisters healthy and well formed. Patient presents no other abnormalities or defects, congenital or acquired.

As shown by the sketch (Fig. 1), the left upper extremity is very rudimentary, extending but little more than half way down the chest wall, to which it is adherent, instead of down nearly to the left knee. The limb terminates in a free foot-shaped projection, of which the heel corresponds to a rudimentary thumb and the remainder to a partially flexed and fairly well-developed index-finger.

Movements of the limb are principally elevation of the shoulder and flexion of the remaining dwarfed segments.

External examination reveals a fairly well-developed clavicle, an acromion, a very small humerus, an elbow-joint, small forearm bones, and in the index small nodules of bone corresponding to a carpal, a metacarpal, and a phalanx. The presence of the elbow-joint was confirmed by Dr. Astley P. C. Ashhurst.

Internal examination by Röntgen rays served to orientate the skeleton of the limb more accurately. The first skiagram taken (Fig. 2) shows a comparatively well-developed clavicle, a rudimentary acromion, coracoid process, humerus, forearm, carpal, and digit bones. As it was afterward determined, the scapular spine was obscured in this picture by the shadow of the clavicle. Because the glenoid rim and elbow-joint were not well shown, another skiagram was taken (Fig. 3). Now the upper extremity of the humerus was found in juxtaposition with a rudimentary glenoid, from which there faded away below an indistinct axillary

border. The scapular spine is now shown. The position of the elbow-joint is brought out by the partially flexed forearm. The radius and ulna here form a common shadow.

Epiphyses are lacking, and the bones have advanced but little in development beyond a stage represented by the early months of intra-uterine life.

It is not claimed that this interpretation of the skiagrams is wholly accurate, but it is the result of careful study, in which the author sought the aid of Professors G. A. Piersol, H. K. Pancoast, G. G. Davis, and T. T. Thomas, and the artist, Mr. Erwin Faber. The case occurred in the service of Dr. B. A. Thomas, at the University Hospital.

To crown the interest of the case there is the usual history of maternal impression. The mother, when two months pregnant, answered the door-bell in response to a mendicant who exhibited to her his left shoulder, which bore the stump remaining after a railroad-amputation of the upper extremity.

LITHOTOMY UNDER SPINAL ANÆSTHESIA.

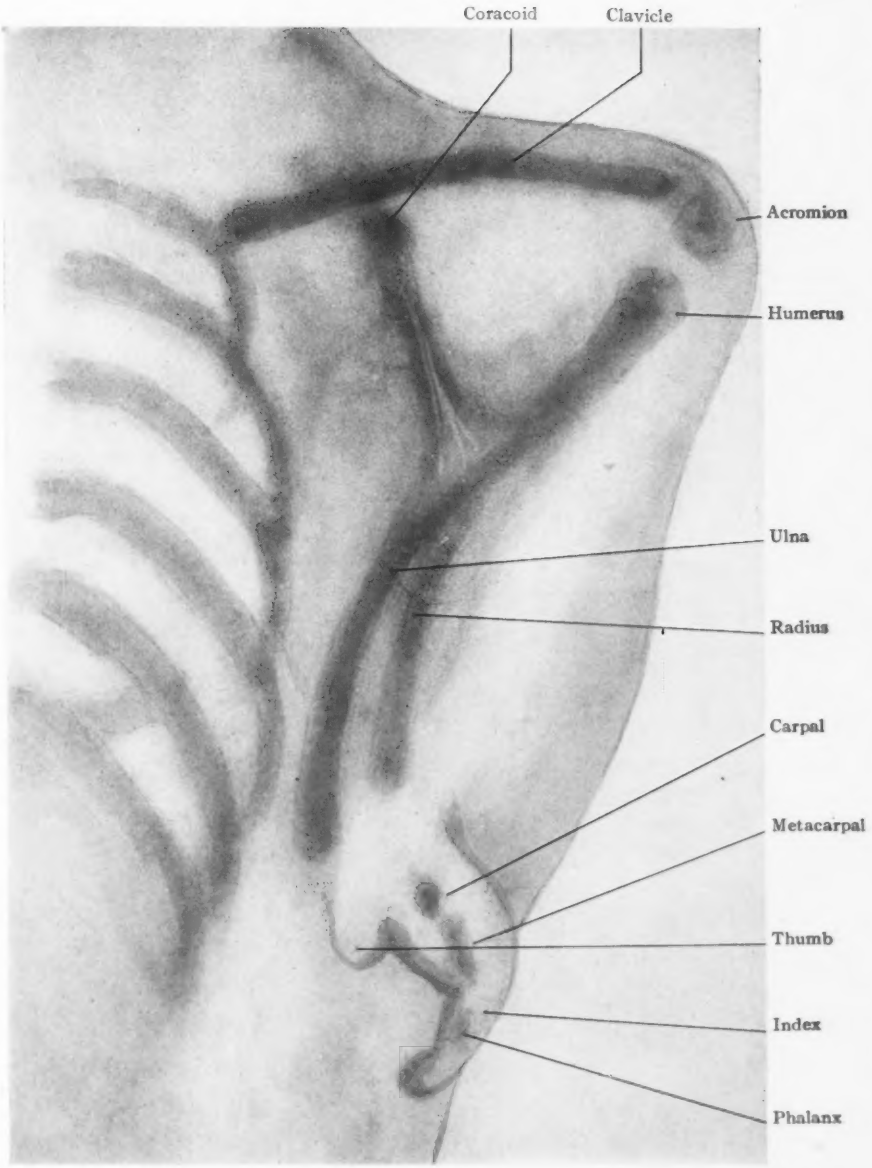
Dr. Harry S. Carmany read the history of a man, 61 years of age, who was admitted to St. Timothy's Hospital with a vesical calculus. On account of a chronic cough it was thought a suitable case for spinal anæsthesia, which was employed according to Professor Bier's original method, between the fourth and fifth lumbar vertebræ, first using ½ c.c. of a 1 : 1000 adrenalin solution, along with 2 c.c. of normal salt solution, waiting five minutes and then introducing 2 c.c. of a 1 per cent. solution of cocaine. After waiting ten minutes the operation was proceeded with. Anæsthesia was complete from twelfth rib down. Operation was started about 5.10 P.M. and completed about 5.40 P.M. Did not have return of sensation until 7 P.M. and was not complete until 9 P.M., although at 5.50 patient had profuse sweating, was slightly excited, felt a little faint, and had a subnormal temperature. Strychnine and atropine were given with prompt improvement. At 8.30 was given alcoholic rub, as sweating was still profuse. The stone was removed suprapubicly, with drainage tube for four days, when permanent catheterization was instituted for a week or ten days. Convalescence uninterrupted. Suprapubic wound healed four and one-half weeks after operation.

Dr. B. A. Thomas called attention to another method of

FIG. 1.

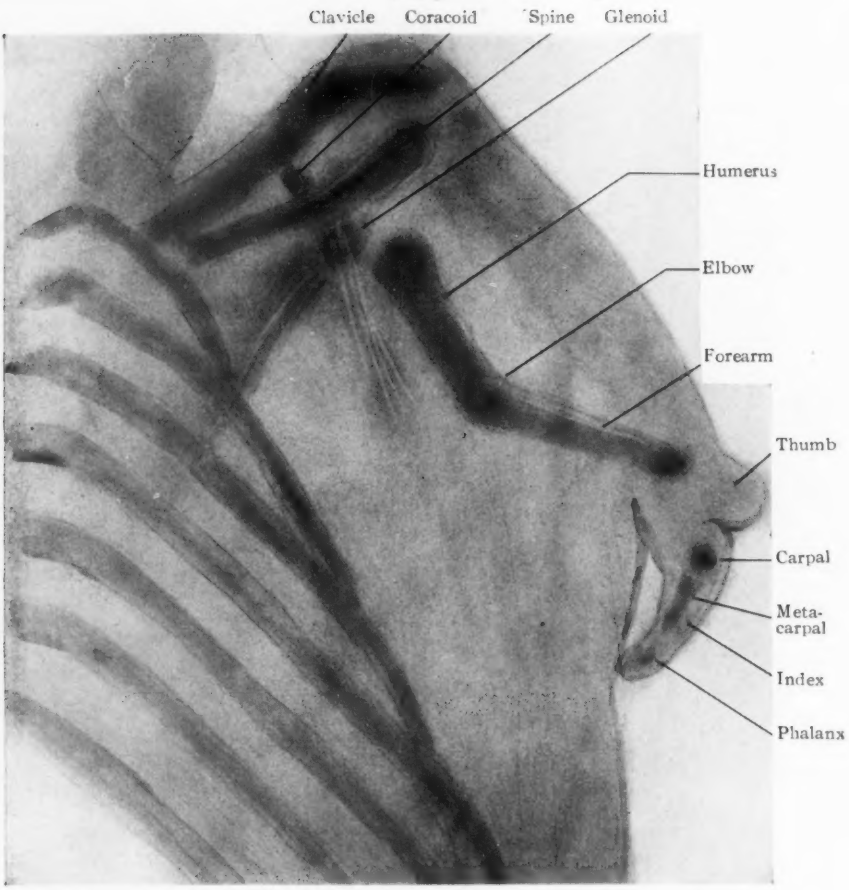
Rudimentary left upper extremity (perobrachium).

FIG. 2.



Rudimentary left upper extremity (perobrachium).

FIG. 3.



Skiagram of left upper extremity taken from behind and mesially forward and laterally.

removing vesical calculi, particularly small ones not more than half a centimetre in diameter, namely, by the use of Young's cystoscopic rongeur. About six weeks ago he had a case in which there were two small calculi which were removed by this method. The device consists of a beaked instrument shaped somewhat like an ordinary urethral sound which opens out on a hinge on its posterior surface like a clam shell, and passing through the hinge, as it were, is a straight cystoscope through which the stone is seen while grasping it with the expanded tip. One of the two stones removed by the use of this instrument was really larger than is applicable to this method and therefore had to be crushed before it could be removed.

Dr. James P. Hutchinson said apropos of spinal anæsthesia, that some years ago Dr. Le Conte and he were abroad together, and saw Dr. Tuffier use his spinal anæsthesia. After returning home they tried it regularly in the first fifty or more cases of operation below the umbilicus; it was uniformly successful, but the large majority of patients objected to the mental depression and, in many cases, the headaches that followed its use. They then discontinued its use, but he had recently taken it up entirely in prostatic and bladder cases if the patients would allow it.

It has an advantage which Dr. Carmany did not mention, and that is that there is absolute and complete relaxation of the patient. In a bladder case, using ether, one is apt at times during the operation to get rigidity of the abdominal wall, which never occurs in spinal anæsthesia. Spinal anæsthesia also has a great advantage in that in elderly individuals the patient can be gotten out of bed in four or five hours after the operation, after the effect of the paralysis of the lower limbs has subsided, while with ether they are apt to have nausea and vomiting and be upset for a day or more, with a much greater probability of subsequent pneumonia.

Dr. Astley P. C. Ashhurst referred to a recent paper by Dr. Bevan, of Chicago, in which he unqualifiedly condemns spinal anæsthesia. There is no doubt whatever that there are a great many cases where local anæsthesia will do as well. It will not do to use local anæsthesia in removing an enlarged prostate, but it can be used in doing suprapubic cystotomy and even in removing a stone from the bladder. If a surgeon has a little patience and a light hand, and keeps the operating room quiet, he can do many operations under local anæsthesia without resorting to the more dangerous spinal form.

Dr. Charles F. Nassau believed with Dr. Ashhurst that if simpler means were tried the same results could be attained without treading on such dangerous ground in many cases. If one has persevered in obtaining a more or less extensive experience with local anæsthesia, infiltration anæsthesia, there are very few operations within reason to which the method cannot be applied. Hernias, bowel resections, exploratory sections, amputations of the arm and thigh can be perfectly well done under local infiltration and nerve blocking. There is no objection to combining anæsthetics, for instance, in operating for a tightly strangulated femoral hernia, which is one of the more difficult types under local infiltration because it is a little hard sometimes to reduce the constriction without causing the patient some pain. In such a case the patient can be given a few breaths of nitrous oxide. One can benumb the patient thoroughly with morphine before beginning, and personally he would feel that while operation should never be refused if strongly indicated in the aged, yet he would go a long way before he would use spinal anæsthesia, the use of which may possibly result in later trouble. He knew of two patients who, he had been told, are wrecks from spinal anæsthesia used for the purpose of operating on hemorrhoids.

Dr. Robert G. Le Conte said that he had had very much the same experience as Dr. Hutchinson. When they were together some years ago at Tuffier's clinic, they were impressed by his method and technic of administering spinal anæsthesia and with the results obtained at the time of operation. Under this stimulus they tried it on a number of cases at the Pennsylvania Hospital. Their conclusions were that in old people, with bad arteries, bad kidneys, and poor circulation, this anæsthetic was the safest one that could be used. He had done a number of grave operations on patients of this type, without shock or variation in the pulse-rate. He had not had the good fortune to do major operations under infiltration anæsthesia with as little disturbance to the nervous system and to the circulation as under spinal anæsthesia. He had, therefore, become a firm believer in, and a strong advocate of, spinal anæsthesia in this limited group of cases.

Dr. George G. Ross thought one of the great difficulties with regard to stovaine is that there is no standardization of the dose with regard to the weight or age of the patient, and hence what would be an overpowering dose for one man may totally

fail to anæsthetize the next one. He had seen one fatality under stovaine in a case of strangulated hernia; in this case he thought a local anæsthetic would have been preferable. The patient died promptly after the stovaine was thrown into the membranes around the cord. He had seen a number of cases where active and violent convulsions resulted from the combination of strychnine and stovaine. It took considerable time and prolonged artificial respiration to tide the patients over the immediate effects.

THE INDICATIONS FOR AND AGAINST THE OPERATIVE TREATMENT OF SIMPLE FRACTURES.

Dr. John H. Gibbon read a paper with the above title, for which see page 329.

Dr. Richard H. Harte said that the operative treatment of fractures which has been so much before the profession of late years is largely the outcome of the imperfect treatment accorded these patients. Again, it is largely due to lack of interest on the part of many surgeons who should know better how to treat fractures than they do; they rarely take but a passing interest in fractures until they find they are resulting badly, their attention being called to this fact by the house officer.

He was exactly in accord with Dr. Gibbon in regard to the treatment of special fractures. Take fractures of the shaft of the humerus, around the anatomical and surgical neck. Those of the anatomical neck are comparatively rare. There is very little disposition for entanglement and the question here is more of reduction and retaining the arm in position after reduction; a satisfactory result follows in the great majority of cases, particularly if the suggestions presented in this paper are followed. Again, the same thing may be said about the elbow-joint and in the shaft of the humerus. In the treatment of all fractures the question should come up with regard to the displacement: What is causing it, is it muscular, or is it a result of the bones being driven past each other by violence, or due to entanglement? In his experience, except where there is entanglement, one can usually reduce all fractures. By entanglement he meant pieces of muscle, fascia, etc., getting between the ends of the bones, and these can be eradicated only by exposing and removing the obstructing material.

There are certain bones and certain portions of bones in which entanglement is more frequent, each as in the central portion

of the bones of the thigh because of the great masses of muscle surrounding them, in the forearm, and also in fractures of the tibia. In fractures of the shaft of the thigh Dr. Gibbon has very properly emphasized the importance of bringing the lower fragment to the upper fragment in fractures high up; Dr. Agnew laid stress upon this point years ago. He used a double inclined plane and made extension a little below the knee.

He was strongly of the feeling that if surgeons will carefully analyze their fractures and find exactly what the displacing element is, they will get better results than they are getting to-day. Often on taking an X-ray, when the fragments are apparently in position it is found that a great deal of displacement exists, particularly laterally; the plane of fracture is almost straight, but the bones are separated from one-half to three-quarters of an inch with tissue between; these cases should be operated upon. He did not know any class of surgery where the judgment of the surgeon is more taxed than to say what cases should be operated upon and what should not. The reason ununited fractures occur is because a band of fascia or piece of muscle has gotten between the ends of the bones.

Another important point is the necessity of going into these cases before it is too late, not after subjecting them to extension for four, five or six weeks. The surgeon should find out as soon as possible whether he had gotten the fragments in position; then he should not wait too long, because it complicates the operation materially; the changes for repair are much better the earlier the operation.

With regard to Pott's fracture, he had seen such cases operated upon, but he did not think they should be. If treated intelligently, by carrying the foot well in a fracture box with two pieces of bandage and binding the leg around, or putting on the Dupuytren splint, one will get satisfactory results. It gives a chance for the deltoid ligament to recover itself, and a patient after a fracture of this sort should walk on the outside of the foot because the ligament will gradually give way, and in time if the foot is well carried in it will just about balance itself.

Dr. John B. Roberts said that he recalled looking a few months ago over a paper by a New York surgeon, in which were reported quite a large number of cases of fractures of the thigh bone operated upon because they had been united in

malposition or because they could not be reduced. He read carefully his statements as to the previous line of treatment and in a large proportion the patients had never been subjected to efficient non-operative surgical treatment. Nearly all of them had been treated by long external wooden splints or other splints, or by an inclined plane, and not by extension with Buck's stirrup and pulley or other methods of maintaining traction. For one to operate on fracture of the shaft of the femur, because it could not be reduced, when he never had tried continuous traction with 25 or 30 pounds weight, is in his opinion an error. If he had previously seen these cases himself and treated them in a rational manner, doubtless operation would not have been considered necessary. He thought Dr. Gibbon to be entirely right in stating that the great majority of fractures can be treated by non-operative means; and that when this is not successful the failure is due to either the patient's own negligence, or to a want of mechanical sense and attention on the part of the surgeon. It is often due to the fact that the after-treatment is conducted by young medical men or by nurses, who are not familiar with the mechanical principles involved and the anatomical displacements. Each individual case should be treated in accordance with the mechanical and anatomical problems involved. In a great majority of fractures of the humerus or the bones of the forearm and of the bones of the lower extremity, the surgeon will obtain good results without operation, if he has a mechanical turn of mind and gives intelligent and frequent supervision to the patients. It will not do, however, to leave them to doctors or nurses without experience and knowledge of non-operative methods. He discovered not long ago that fractures of the femur treated by him in a hospital had been accustomed to have a bedpan about two or three inches high put under them by the orderly while the broken limb was weighted with from 15 to perhaps 30 pounds. He only found it out by seeing the thing occur as he walked into the ward. That is the kind of thing that surgeons' indifference and negligence in fracture cases have allowed to go on in hospitals; and it perhaps accounts for the lack of good results in many cases. Dr. Gibbon is right, that attentive surgical observation will prevent many bad results.

It seems proper to lay stress on the treatment of fractures by gypsum splints. The average surgeon nowadays pays no

attention to the use of plaster of Paris as a means of making a perfectly fitting splint.

The X-ray is a valuable adjuvant in diagnoses; but it is a most incorrect aid unless a surgeon supervises the taking of the picture and then uses his own fingers and clinical sense to act as a source of contrast and addition to the X-ray plate. In some hospitals the patients are taken out of bed, put on a stretcher, and taken to the X-ray laboratory by a probationer nurse or inexperienced resident. It is perfectly possible for the X-ray man to make almost any kind of a picture by changes in the line and angle of the rays. We are liable to pay too much attention to the X-ray picture and think we have a badly set fracture when the truth is that the appearances are factitious. It requires often the combined knowledge of the radiologist and the surgeon to correctly translate the shadow picture.

Dr. Gwilym G. Davis said that Dr. Gibbon's paper brings up one aspect of surgery that is suggestive, and that is the relation of the conservative to the radical, and the question of the conservative treatment of surgical affections of the extremities. When it comes to a discussion as to whether the treatment of certain cases shall be conservative or radical, it devolves upon the surgeon to be qualified to decide that question. In other words, he should know what can be done by conservative means; to be qualified to treat a part conservatively he should understand conservative methods and should be willing to take the time and trouble to become familiar with and carry out such methods. The tendency in the development of surgery during recent years has been toward visceral surgery; the consequence has been to drift away from extremity surgery. Visceral surgery has developed to such a tremendous degree that it has been practically impossible for many surgeons to keep pace with the developments of surgical science in conservative fields, and we therefore see them devoting their attention almost exclusively to operative and visceral surgery, the abdomen, brain, etc., to the exclusion practically of such things as fractures and other surgery of the extremities. Still retaining their position as general surgeons to institutions, these cases of fracture, etc., fall under their care although they have not kept pace with the development of the conservative side of the art. The consequence is that they must do one of two things, either relegate the treatment of these cases

to others, or undertake them themselves. Some do one thing, some another. When they undertake the treatment themselves, they are confronted with the alternative of either treating them inefficiently conservatively, or else operating upon them, and likewise inefficiently, and it has been a matter of surprise to him that Mr. Lane's work, commendable as it is along some lines, has aroused such enthusiasm. No one could admire his technic more than the speaker, and yet the choice of his cases leaves much to be desired. Exactly what course will be pursued by the surgical profession is a matter of great interest. If the general hospital surgeon is going to treat fractures in the future, he will have to begin to study fractures from a conservative stand-point, and perhaps after the furor which has recently occupied the surgical world for visceral surgery has passed, there may be a reaction, and then these cases will again receive the attention which they deserve. In the meantime, however, some institutions are finding a solution of the problem by turning such cases over to the members of the staff who are accustomed to deal with things from a more conservative and mechanical stand-point.

Dr. John H. Jopson asked whether the amount of extension applied by Dr. Gibbon relatively to the arm and forearm and thigh. In the past he had often been content with an insufficient amount of extension in the treatment of fractures of the thigh, and lately he had been in the habit of increasing the weight with less regard to the age of the patient, until satisfied with the reduction obtained. He did not know whether in doing this the ligaments of the knee-joint might be injured. The question of the strength of these ligaments must be considered both in the treatment of simple fractures by Buck's extension, and in the newer methods of reduction, for example, that employed by Dr. Lemon of Milwaukee, which he recently demonstrated in this city. In Lemon's apparatus, one in which the mechanical details have been worked out in the nicest manner, the extension which is used to effect reduction is applied to the ankle by means of a special gaiter, which is removed after the plaster cast has set. The amount of extension employed can be carried up to 150 pounds. In Martin's method the extension is applied directly from the upper end of the lower fragment. Lemon's apparatus he applied for in one case and Martin's apparatus as modified and perfected by Eliason he had used very recently, and

undoubtedly if there is no danger in the application of this very great amount of force below the knee-joint there is an advantage in the use of Lemon's apparatus, because in Martin's method you have to remove the retractor before pinning or plating the fragments.

Another question in the experience of the author is shock in operating on fractures of the femur, especially in the upper portion. As everyone knows there is oftentimes serious shock in operations on the femur, and in cases where the hemorrhage is slight may it not be that the traction itself can be responsible for this shock?

In spite of the opposition manifested in some quarters to the operative treatment of fractures, one must realize that in selective cases it has come to stay, and that we will be in the future less and less satisfied with incomplete and imperfect reduction of fractures.

Dr. John H. Gibbon (in closing) said that he thought highly of Lane's plates and that there is no technic better than his, but what he had seen is a plate employed in fractures and applied to bones where it should not be used; for instance, on the olecranon, the internal malleolus, and the patella. Lane has done the best work of any man in the treatment of fractures. His selection of cases, however, seems bad, that is, he takes cases which we would not operate on. A great many of the cases which are reported by many operators are those which the surgeon has not seen until a resident or his assistant says, "We have a bad result and I guess you will have to operate," and this after partial union has taken place and a lot of callus developed. Such a case should have been operated on just as soon as it was discovered it could not be gotten into proper position. Late operations give bad results.

As to the residents: He finds residents get enthusiastic about the same things their chiefs get enthusiastic about. If one shows a certain amount of interest in fractures and demonstrates to the resident what he can do, for instance, in fractures of the upper end of the humerus by abduction, he will be impressed and become interested, and if, on the contrary, one pays no attention to the fracture cases, he will only call attention to them when they are in bad condition for operations and beyond mechanical correction. Surgeons want to familiarize themselves

with the improvements that are made in the mechanical treatment of fracture just as much as the improvements in technic. General surgeons are competent to treat fractures, but when it comes to operating on them the man who understands this should be very familiar with such work.

There is one point he wished to emphasize, and that is the matter of continuous traction. Ten pounds kept up for a week will do more than 30 pounds for half an hour. Regarding the shock in thigh fractures, he thought that the shock accompanying and following fractures of the thigh is often one to fat embolism. He had no proof at all, excepting that large amounts of fat are eliminated in fracture by the urine. The student is to-day not receiving the amount of instruction in mechanical treatment of fractures that he should and it must be made up to him during his internship by those under whom he serves.

FRACTURE-DISLOCATION OF THE SHOULDER.

Dr. William J. Taylor reported the history of a man of 50 of lax fibre and poor muscular development, who in the spring of 1910 made a misstep and in jumping forward to regain his balance placed his foot upon a small rug lying upon a hard-wood floor. The rug slipped and threw him forward, and in his efforts to save himself from falling, he extended his left arm, his hand coming with great force against a wall. A dislocation of the shoulder resulted. As the accident happened in the country, there was some delay before he could be seen by a physician. Finally a man of large experience and a most excellent practitioner gave him ether and after a careful examination reduced the dislocation without difficulty, using his foot in the axilla. The arm was then bandaged to the side. Forty-eight hours afterwards he came into town and was seen by Dr. Taylor for the first time. Patient suffered great pain; there was marked swelling, and the bandage was so tight that blebs had formed on the forearm. Dr. Taylor could feel the head of the humerus in its broken place, but the swelling about the shoulder was so great that an accurate examination was impossible. There was an extensive ecchymosis. The swelling gradually subsided, but pain was persistent and an X-ray taken of the shoulder showed the true nature of the injury. The anatomical neck, or rather the articulating surface

of the bone, had been shelled off and remained against the chest-wall beneath the pectoral muscle.

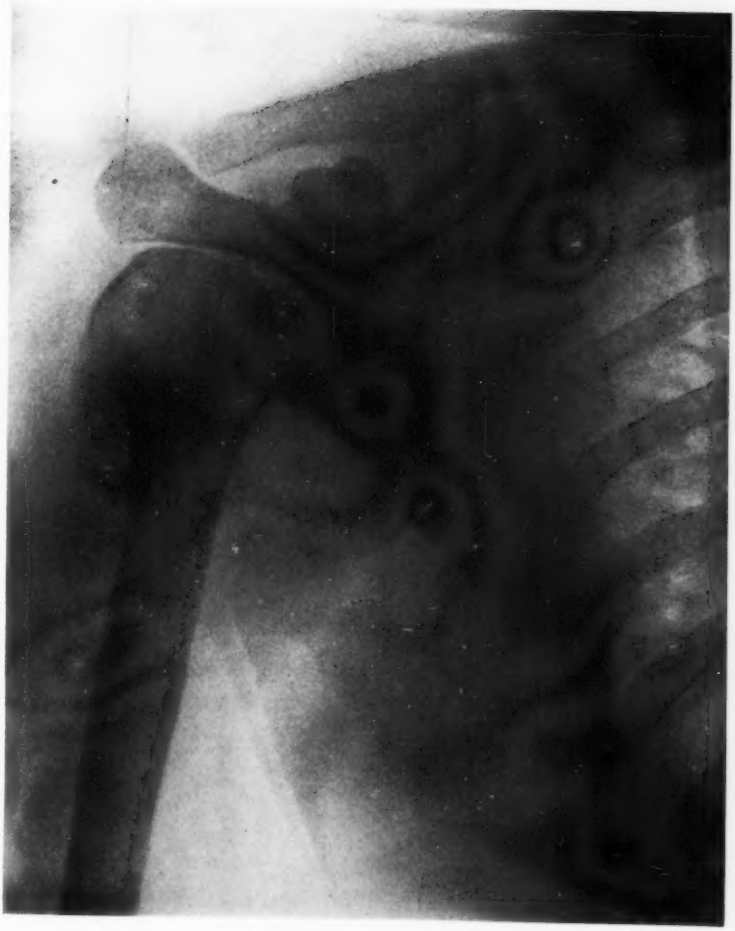
He operated by making an incision along the posterior axillary fold and dissected down past the vessels well into the axilla. The piece of bone could be easily felt through the wound, but so near to the vessels and nerves that it was impracticable to remove it by this route for fear of doing serious damage. Through the same incision he now dissected below the vessels and toward the pectoral muscle and by splitting it the piece of bone was removed. The remainder of the head of the humerus was in place in the glenoid cavity and the capsule of the joint firmly united. The joint was moved freely and a drain of iodoform gauze introduced into the cavity from which the piece of bone had been removed. Convalescence was uneventful, and the patient has a perfectly useful arm and a movable shoulder-joint.

Dr. John H. Jopson said that he saw a case almost identical with this in an old colored woman in the Polyclinic Hospital Dispensary, with an injury of the shoulder which he diagnosed at first as fracture of the anatomical neck. The tuberosities were pulled upward so that no depression was felt below the acromion. The X-rays showed the head in the axilla, and he made an anterior incision and removed it.

Dr. Charles F. Nassau said that four years ago he had an exactly similar injury occur to a patient of his. The man was very stout and flabby, extremely poor physical condition particularly due to dissipation, and he fell out of a low window to the porch, was brought to the city, and was supposed to have had a dislocation which was practically reduced, but the pain persisted. An X-ray was taken by Dr. Sweet, and it was after that that he came under his care. He feared very much to do anything with it, but the X-ray, although not good, was sufficiently so to show a thin "butter plate" torn from the head of the humerus and driven down between the head of the bone and the chest wall under the pectoral muscle. He made an incision through the anterior edge of the deltoid, smoothed the edges after removing the loose piece, and closed the wound with not more than three stitches. That man has a perfectly good arm. With persistent and long-continued massage he has obtained a good result with a freely movable joint.

Dr. Gwilym G. Davis said that when he was Dr. T. G. Mor-

FIG. 4.



Fracture-dislocation of shoulder.

ton's resident he came in contact with a case very similar to this, in which he made an incision just under the edge of the pectoralis major and withdrew the head of the articular surface as did Dr. Taylor. As a person grows older, the line of fracture recedes until it reaches through the anatomical neck, but in this case it has been a little lower and includes a little portion of the upper part of the tuberosity, and on the illustration will be seen a fragment which looks as if part of the tuberosity had been torn.

Dr. John H. Gibbon said that he had an X-ray picture taken of every fracture he treats. The time to take the picture is after the reduction. It is important to teach men that the thing they must do is to have a picture taken, and if not it is up to the patient, because so frequently patients turn up who never had a picture taken and have a bad position. Everyone taking a fracture must ask for an X-ray plate. As Dr. Harte has shown, it may sometimes mislead. He had seen two fractures that from a clinical point of view were perfectly apparent but which did not show in the X-ray plate because it was only taken in one line. With a stereopticon picture there is no excuse for a misinterpretation. We often do not need it as a diagnostic means, but rather as a confirmation of the proper reduction of the fracture; he does not consider it a criterion as to the result.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, Held at the Presbyterian Hospital, November 22, 1911.

The President, Dr. Charles L. Gibson, in the Chair.

RECURRENT PANCREATIC CYST.

Dr. Clarence A. McWilliams presented a woman of 50, who was first admitted to the Presbyterian Hospital on October 25, 1910, her chief complaint being pain in the left upper abdomen. Her history dated back fourteen years, when she had her first attack of pain, which started in the left upper abdomen and radiated upward to both shoulders; never down or around to the back.

Examination of the upper abdomen showed a transverse, indistinct mass, about the size of a grape-fruit, with its lower border extending four inches below the navel. It was smooth, not tender, dull on percussion, and deeply situated.

On October 28, 1910, an exploratory laparotomy was done through a median incision. Above the navel and occupying practically the entire left upper quadrant of the abdomen, was found a very large, smooth, cystic swelling, which lay behind the stomach and extended up to the diaphragm. Its position was that usually occupied by the pancreas. A needle was passed through the lesser omentum, and then, with a trocar and cannula, at least a quart of fluid, turbid, odorless, and chocolate colored, was drawn off. A tube was then sewn into the cystic opening with purse-string suture. The abdominal wound was then closed about the tube, and the patient made an uneventful convalescence.

During the first 24 hours, about eight ounces of fluid drained through the tube. Two weeks after the operation, this fluid gave a faintly alkaline reaction, with a specific gravity of 1022. The fat-splitting reaction was present, with a marked reaction; the

diastolic ferment was also present as well as a marked trypsin reaction.

The tube was left *in situ* for eighteen days, and then drawn outward so that its end lay just inside of the abdominal wall. The patient left the hospital on December 4, 1910, afterward visiting the accident ward for dressings. The sinus in the abdomen continued to discharge for three months longer, and then healed entirely and remained so.

The patient was readmitted to the medical division of the hospital on September 1, 1911, complaining of pain in the left hypochondrium, which was at times dull, at other times sharp. She had lost flesh and strength, and suffered at times from nausea and vomiting. On physical examination a very indistinct soft mass, not tender, was felt in the left upper quadrant of the abdomen. A Wassermann reaction was negative, but a Cammidge reaction was positive.

Operation, September 15, 1911: An incision was made through the old scar. Through the stomach could be felt a smooth, cystic mass, about the size of a grape-fruit, lying below the diaphragm in the left upper quadrant. The gastrocolic omentum was incised, the cyst wall exposed, and the cyst aspirated and opened, and a section of its wall removed for examination. A finger inserted through the wall of the cyst extended upward to the diaphragm and to the left as far as the spleen. The cyst wall was sutured to the abdominal wall, as complete incision of the cyst was impracticable. A tube was left inside of the cyst.

A microscopical examination of the cyst wall showed no epithelial lining, and no pancreatic tissue was found in the sections. An examination of the fluid from the cyst showed the presence of weak ferments.

The patient made a smooth recovery from the operation. On September 25, an examination of the fæces showed poor pancreatic digestion. Trypsin and diastatic digestion were diminished, and the total undigested fat was increased to 68 per cent. The patient was then given extract of pancreas, and on October 6 the total fat had diminished to 15 per cent., showing improved pancreatic digestion.

Dr. McWilliams said he attributed the recurrence of the cyst in this case to the fact that at the first operation the cyst wall was not sewn to the abdominal wall, causing it to close too soon.

RETENTION CYST OF THE PANCREAS.

DR. ELLSWORTH ELIOT, JR., presented a man, 46 years old, a native of Hungary. His occupation was that of a salesman. His family history was negative, and his past history, with the exception of the fact that he had suffered from constipation for the past ten years, was unimportant.

About a fortnight prior to the patient's admission to the Presbyterian Hospital, on October 2, 1911, while walking, he had a sudden, sharp pain in the left side of the abdomen. This was increased on deep inspiration, and upon examination the patient noticed a swelling just below the left costal margin; this was painless on pressure. The sudden pain, which persisted, was most severe in the left hypochondrium; it did not radiate, and was relieved by lying down on the left side. There was no vomiting. The appetite and digestion remained good up to a few days before admission, when the patient had a sudden chill; no fever. The swelling gradually increased in size.

Upon admission, the patient's temperature was 98.5°; pulse, 88; respirations, 22. In the left upper quadrant of the abdomen, bounded by the midline and on a level with the umbilicus, there was an ovoid swelling about the size of a large cocoanut. It was elastic to the feel and dull on percussion. It moved with respiration, and was not adherent to the overlying skin. Upon inflating the stomach, the mass almost entirely disappeared, but only temporarily.

The peritoneal cavity was opened by a vertical incision through the upper outer part of the left rectus. A large cyst immediately presented, pushing the gastrohepatic omentum forward. The cyst wall was exposed by a reflection of the divided gastrohepatic omentum to either side, and after examination of its content the portion of the cyst wall was excised and the edges sutured to the parietal peritoneum. The cavity was drained by a rubber tube and the incision in the abdominal wall closed by the usual suture.

After the operation the discharge was abundant and contained pancreatic ferment for three weeks. It then suddenly diminished and during the past month has varied considerably in amount. At present there is practically no discharge and the wound healed.

FRACTURE OF THE OLECRANON.

DR. MCWILLIAMS presented a woman, 50 years of age, who was admitted to the Presbyterian Hospital on September 20, 1907, ten days after she had sustained a fall upon her elbow.

On examination, one could feel a fracture of the olecranon, with separation of the fragments of about half an inch. An X-ray photograph showed a transverse fracture of the olecranon, about an inch from its upper extremity, the fragment being displaced upward and backward by the triceps so that its fractured surface looked posteriorly.

An incision five inches long was made over the posterior surface of the olecranon, and the line of fracture exposed. A hole was drilled transversely through the lower fragment, a quarter of an inch from its posterior surface. A moderate sized aluminum bronze wire was then passed through this hole, threaded on a needle and passed through the triceps tendon, just above the upper fragment. The wire was then drawn taut, and the ends twisted together on the outer side of the ulna. When the skin stitches were removed on the eleventh day, primary union had taken place.

An X-ray picture taken recently, four years after the operation, showed the wire in its original position. The fracture had firmly healed, so that even its location could not be made out by palpation. Flexion and extension were perfect, and there was no pain. The question of whether it is wise to use an unabsorbable suture material about joints is brought up by this case. Usually chromic gut is preferable, but this case shows that wire may be used. Its advantages are that much more freedom is allowed in the position in which the joint is placed immediately after the operation, as well as earlier subsequent active and passive motions. The skin sutures of silk or silkworm gut when placed about joints should be left *in situ* for more than the ordinary length of time, at least ten or twelve days, to prevent subsequent separation of the skin edges.

TYPHOID PERFORATION: CHOLECYSTITIS.

DR. MCWILLIAMS presented a man, 39 years old, who was operated on March 19, 1911, at 4 P.M. He was suffering from typhoid fever, and was then, it was calculated, in the twelfth day of the disease. He had slept well the entire preceding night,

and at 7 A.M. complained of a sharp pain in the abdomen, in the region of the bladder. At eight o'clock he was given an enema, which brought away yellow fluid and some soft fæces. Two hours later he felt nauseated and refused milk.

When Dr. McWilliams first saw the patient, at three o'clock in the afternoon, his pulse was 96, temperature 103°, with a white blood-cell count of 13,600. There were rigidity and tenderness of the right rectus, more marked below than above. There was also some tenderness in the left lower quadrant. There was no distention; liver dulness normal; flatness in the flanks. A rectal examination elicited slight tenderness.

Operation, 4 P.M.: The abdomen was opened under cocaine through the right rectus muscle without the slightest pain. Upon opening the peritoneum, some fluid escaped. On attempting to draw the cæcum into the wound, the pain was so severe that ether by the drop method was given. The cæcum and ileum were then drawn out, and a small perforation, the size of a knitting needle, was found about eight inches from the ileocæcal valve. The perforation was closed by a purse-string Pagenstecher silk suture. There was considerable fluid, with a small amount of fæces in the pelvis, which was washed out by means of a catheter attached to an irrigator, by the side of which a suction tube was passed. Two rubber tubes were inserted to the bottom of the pelvis, and the abdominal wound was sutured around them.

On the following morning the patient's temperature had dropped to normal, and remained so for two days, with a pulse of about 100. Then there was a gradual rise in temperature. There was no vomiting. The slight distention was relieved by colon irrigations. The tubes were removed on the eighteenth day, and gauze strips substituted. On the sixth day after the operation, the temperature became higher, reaching 103° on the sixteenth day. This temperature persisted for 21 days, and was due to a cholecystitis, as shown by a very tender gall-bladder region, with muscular rigidity. The leucocytes were as high as 21,800 and the polymorphonuclears 88 per cent. After this the patient made an uninterrupted recovery, and has been well ever since, with no subsequent intestinal disturbance nor pain in the gall-bladder region.

Dr. McWilliams said that in the Presbyterian Hospital they had operated on 20 cases of typhoid perforation since 1900.

Their results had not been brilliant, for only four of these 20 recovered—20 per cent. Armstrong (*British Med. Jour.*, Oct. 29, 1910) stated that in the Montreal General Hospital, from 1897 until May, 1910, there were 2051 cases of typhoid fever, with 93 perforations—4.53 per cent. Of these, 78 were operated on, with 24 recoveries—30.7 per cent. In six of these cases, more than one perforation was found—7.7 per cent. The perforations were generally not far removed from each other.

LATE CONDITION AFTER EXCISION OF THE SUPERIOR MAXILLA FOR SARCOMA.

DR. C. A. MCWILLIAMS presented a man of 40, who was admitted to the Presbyterian Hospital on November 15, 1909, with a hard, bone-like tumor, about the size and shape of a walnut, occupying the right superior maxillary bone, and extending into the right nostril. It was raised as a globular swelling from the side of the nose and face. The skin covering the tumor was not movable, being firmly attached to the growth, which felt like a part of the upper jaw. On the right side, beneath the upper lip, the growth could be seen involving the gums in irregular, nodular projections, which bled easily. The orbit was not involved. The first evidence of the growth had been noticed seven months before. A section of tissue removed showed it to be a giant-celled sarcoma.

Operation, November 16, 1909: After a preliminary injection of morphine, ether was administered through the left nostril by catheter. After ligation of the right external carotid artery, the right superior maxillary bone, with the tumor, was extirpated.

Two years after the operation this patient is perfectly well, without any signs of recurrence. He wears a plate filling in the defect, which is of great assistance to him in enunciating clearly.

BILATERAL LYMPHOSARCOMA OF THE BREASTS.

DR. C. A. MCWILLIAMS presented a woman, 33 years old, who was admitted to the Presbyterian Hospital on June 13, 1911. Two weeks previously she had noticed a lump in the right breast, three and a half inches from the nipple and just to the upper and outer side of the mammary gland. The lump was the size of a large marble, and apparently was not increasing in size. There was no pain nor loss of weight. The woman was the mother of one healthy child, eight years old.

Examination showed a nodule, about the size of a hickory-nut, not tender nor cystic, in the right mammary gland, at its upper, outer quadrant. It was not adherent to the skin nor deeper parts. No axillary nodes were palpable. The remainder of the breast contained no nodules, and the opposite breast was normal.

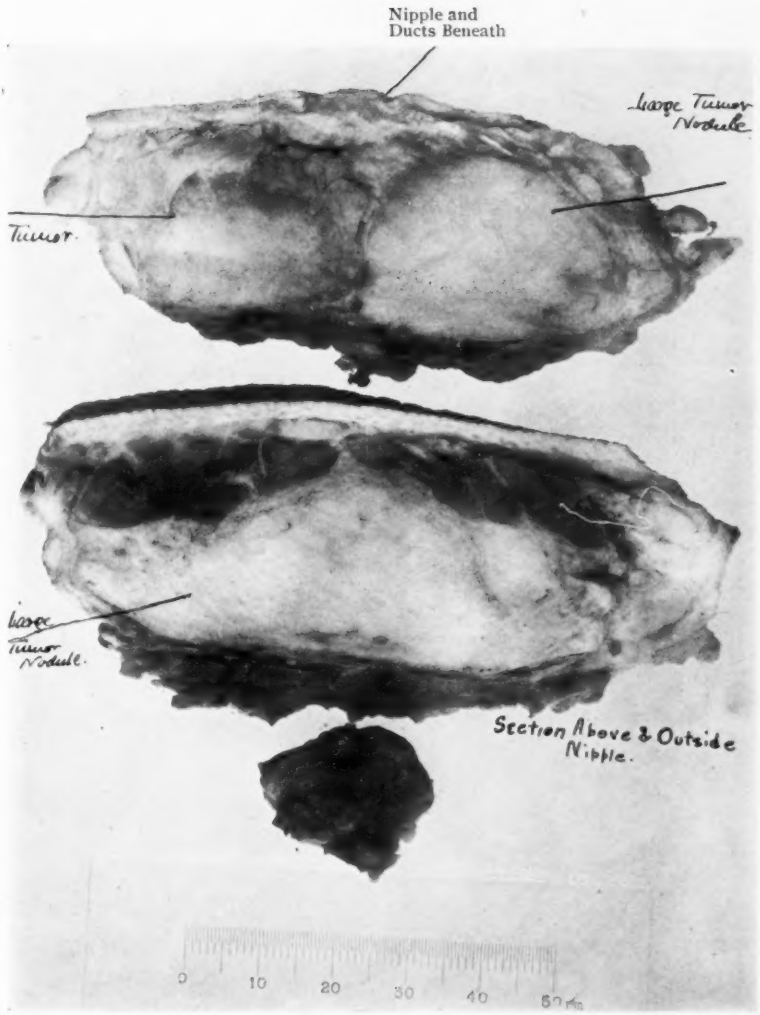
Operation, November 7, 1911: This consisted of the removal of a bit for the frozen section examined, but as the result of this examination was not satisfactory, the wound was closed. A subsequent pathological examination of the tumor was made, and it was pronounced a benign lymphoma.

The patient returned to the hospital on November 5 with a statement that about two weeks after her discharge a small lump had developed in the right breast near the old scar, and following this, other lumps had developed in the same breast, until she now had four or five of them. About two weeks ago she noticed a lump in the left breast. All of these tumors had been steadily growing larger. There was no pain; no discharge from the nipple; no loss of weight or strength.

Examination of the right breast showed three hard, nodular masses. These were circumscribed and freely movable under the skin. There was no tenderness nor fluctuation, and the nipple was not retracted. In the right axilla there was a mass about the size of a hickory-nut. In the left breast there were two distinct masses, also freely movable under the skin, and very hard. There was no retraction of the nipple. They were situated in the upper quadrant of the breast. Nothing could be felt in the left axilla. The Wassermann reaction was negative; the spleen was normal. There were small, palpable glands in both inguinal regions. Spleen not felt.

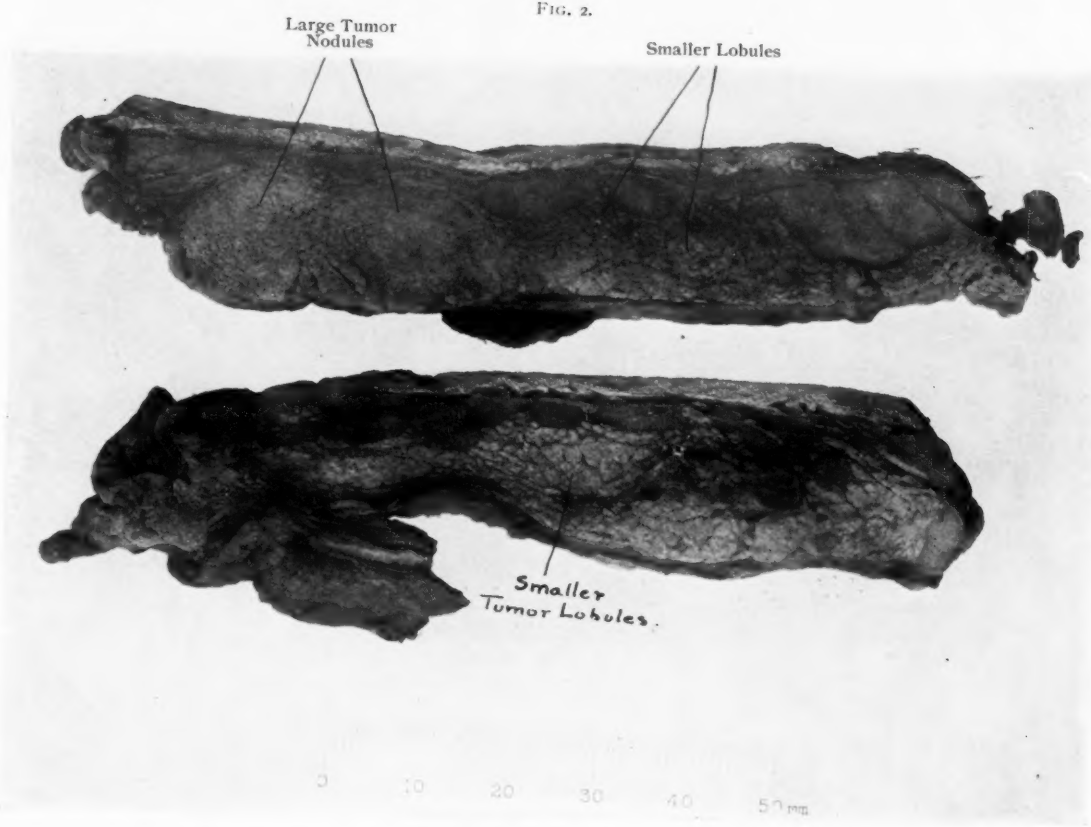
Operation, November 7, 1911: This consisted of the complete removal of the right breast, together with both pectorals and the contents of the axilla where several large lymphatic tumors were removed. Eight days later a similar operation was done on the opposite side. Considerable shock followed the second operation, and that evening the patient's condition was poor, with dyspnœa and a weak, irregular pulse. As there was very poor response to two saline intravenous infusions, a blood transfusion was done at 9 P.M., with the result that the red blood-cells, which were 3,000,000 before the transfusion, were 3,900,000 after it. Elsberg's cannula was used with easy and good results. The patient's

FIG. 1.



Bilateral section of the right breast.

FIG. 2.



Bilateral section of the left breast.

husband acted as donor without preliminary testing of the two bloods. On the following day the woman's condition was good, the pulse being strong and steady.

The pathological diagnosis in this case was lymphosarcoma of each breast, with involvement of the right axillary glands. The wounds all healed by primary union.

The subsequent course of this patient was remarkable, and showed that we had to deal with a case of acute lymphatic leukæmia, the only objective signs of the condition being the mammary tumors.

On December 3, examination of the eye grounds showed two hemorrhagic spots in the left retina on its temporal half near region of macula. On December 5, the edge of the spleen was easily felt for first time on deep inspiration. The gums of the lower jaw were swollen, spongy, tender, and with small ulcerations. The temperature was high (December 8), 105.6°, and the patient had occasional shaking chills. X-ray pictures showed no apparent enlargements of any of the lymphatic tissues. The wounds are faultless and perfectly healed.

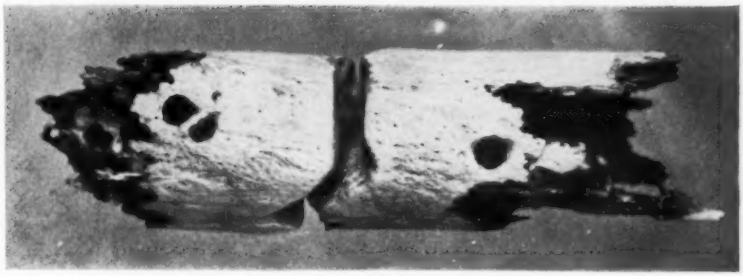
COMPOUND FRACTURE OF THE HUMERUS, WITH SEQUESTRA: RESULT AFTER WIRING.

Dr. C. A. McWilliams presented a man, 32 years old, who was admitted to the Presbyterian Hospital on November 2, 1911. One month previously he had sustained a compound fracture of the left humerus, at the junction of the middle and lower third, for which he was admitted to a nearby hospital. He immediately began to run a temperature, which gradually increased, and on the fifth day he was operated upon with the diagnosis of compound fracture of the left humerus, with cellulitis. Notwithstanding the presence of infection, the fragments were wired. The incision was made over the outer side of the arm, and a transverse fracture exposed. Two holes were then drilled into each fragment, three-quarters of an inch from the line of fracture, and a silver wire introduced and twisted. A counter-opening was made on the inner side of the arm and both wounds were left wide open for drainage, rubber tubes being inserted. During the patient's stay in the hospital, from October 2 to November 1, he ran a temperature, more or less continuous, and averaging

about 102°. During the last few days in the hospital he became wildly delirious and irrational. About two weeks after the operation, the silver wire was found loose in the wound. The patient was expected to die, and he was removed to his home on November 1. When Dr. McWilliams first saw him there on that day, in consultation, the patient was apparently much prostrated, with a very dry tongue and a weak pulse, but with no temperature. He had a compound fracture of the left humerus, the opening into the bone being large enough to admit two fingers. There were several incised wounds on the forearm and on the inner side of the arm. The patient was thereupon sent to the Presbyterian Hospital, permission first being obtained to amputate the arm, should that prove necessary.

On admission, an X-ray photograph was taken, which showed that the ends of both fragments were necrotic (Fig. 4), and from these, two sequestra were removed (Fig. 3). Each sequestrum involved about an inch of the end of the fragment. The remarkable feature about them was the short period of time it took for them to separate—about one month. This also indicated how great a degree of infection there was introduced into the bones at the time of the operation. For a week after his admission, the man was very irrational and delirious. He was given large quantities of fluids, and at the end of one week he became perfectly rational. His delirium was unaccompanied by any rise of temperature. His wound was now granulating nicely, and the question which came up was, what should be done to effect a union of the fragments? There was now a defect of about two inches in the bone. Would the soft parts contract sufficiently to allow the ends of the bone to be brought together and held there by a Lane plate? If not, Dr. McWilliams said, it was his purpose to implant a bone graft taken from the man's tibia, thus filling in the gap with bone. This graft was to be placed in the medullary space of each end of the fragment. Nothing of this kind, however, could be done until all the wounds had entirely closed. On Dec. 8, the cavity between the fragments had entirely filled in and all that remained unhealed was about an inch wide of the skin surface.

FIG. 3.



Sequestra from compound fracture of humerus.

FIG. 4.

Compound fracture of humerus with necrosis of fractured ends.

RUPTURE OF THE QUADRICEPS TENDON OF THE KNEE.

Dr. Forbes Hawkes presented a man, 40 years old, an engineer, who on January 26, 1911, during the excitement resulting from a fire in the building in which he was on duty, slipped from a box on which he was standing, a distance of about eighteen inches, to the floor, injuring both knees. Following the injury, he was unable to extend the left knee. There was a marked, transverse depression above the left patella, and the parts were greatly swollen and of a bluish color, suggesting a deep-seated hemorrhage. There was also some depression above the right patella, but he could extend the right knee fairly well.

The X-ray plate showed that there had been no fracture of the patellæ, but that the left quadriceps tendon, as it tore, had pulled off a few particles of bone from the upper portion of the patella.

On February 1, 1911, the left quadriceps tendon was sutured in place through a trap-door incision. It was found that it had been completely torn away from its patellar attachment, and that the lateral ligaments had been torn as well, opening the knee-joint on the inner side. The retracted tendon was easily brought down and sutured to the rough upper surface and to the periosteum of the patella with double No. 2 chromic catgut sutures. Both lateral ligaments were also sutured with chromic gut. The skin was closed without drainage, and the limb put up in extension on a moulded posterior plaster-of-Paris splint.

There was a slight reaction for twenty-four hours after the operation, but within three days the pulse rate and temperature had fallen to normal. The wound healed *per primam*. About the tenth day and daily after that the patella was moved laterally a few times. The patient was permitted to sit up in a chair, with the limb extended, and at the end of four weeks he was wearing a posterior splint during the day only, and allowing the knee full motion while in bed. A week later all support was removed and increasing motion encouraged. Motion and strength had gradually returned, but being a heavy man, he was advised to make haste slowly. He was now able to climb stairs without assistance. His left limb was a little stronger than the right.

EPIPHYSEAL FRACTURE AT LOWER END OF RADIUS; OPERATIVE REDUCTION.

DR. FORBES HAWKES presented a boy of nine years, who on April 7, 1909, fell in the street, striking on his right hand, sustaining a silver-fork deformity of the wrist, with loss of function, and pain. The X-ray plates showed a separation of the epiphysis of the lower end of the radius. Attempts at reduction, at first without anæsthesia and later with a general anæsthetic, were unsuccessful.

On April 13, 1909, an incision was made on the dorsum of the wrist to the thumb side of the tendon of the extensor communis digitorum, which goes to the index-finger. Part of the posterior annular ligament was divided, access thus being obtained to the fractured area. It was seen that a piece of the radio-ulnar ligament and part of the lower portion of the interosseous ligament prevented reduction. By keeping these structures out of the way by means of retractors, and using a periosteal elevator as a "crow-bar," the fragment was brought into its proper position. To keep this fragment in position, it was found necessary to flex the wrist, and it was fixed in that position. The divided portion of the annular ligament was sutured with chromicized catgut and the wound closed. The hand was put up well flexed in plaster-of-Paris. Primary union resulted. The bandage was removed at the end of three weeks, when motion was encouraged. A perfect functional result followed.

At the present time, about two and a half years since the injury, there was no difference whatever in the growth of the bone. The radius presented no thickening at the epiphyseal site.

ULCER OF THE STOMACH AND OF THE DUODENUM.

DR. GEORGE WOOLSEY presented a man, 36 years old, married, a native of Scotland, and a gardener by occupation. He was admitted to the Presbyterian Hospital on July 6, 1911, at which time he was suffering from an ulcer of the stomach, situated in the lesser curvature near the pylorus. This was excised, an uneventful convalescence following.

He was readmitted Oct. 23, 1911, with the following history: For nine weeks after discharge from hospital he was in good health and gained 8 pounds. Three weeks ago, after an attack

of diarrhœa with colic, which lasted 10 days, he began to have epigastric pain most marked above and to the left of umbilicus, coming on one and a half to two hours after eating, and relieved by taking food. There was tenderness on pressure over the site of the pain. No vomiting, but a great deal of acid eructations an hour or two after eating. Had noticed tarry stools at intervals. No mass felt.

Operation, Nov. 3, 1911, Dr. Woolsey: Posterior no-loop gastrojejunostomy. Gas and ether anæsthesia. Only slight adhesions were found between area of gastric ulcer excised and under surface of liver. Slight induration of stomach wall at this point. One-half to three-fourths inch distal to pylorus is an indurated area on postero-superior aspect of duodenum.

Diagnosis, ulcer of duodenum. Patient made an uninterrupted convalescence and was put on a Lenhartz diet. He was subsequently discharged from the hospital feeling perfectly well.

NEPHROLITHIASIS; PYELITIS; CALCULUS OF THE BLADDER.

Dr. George Woolsey presented a man, 37 years old, who was admitted to the Presbyterian Hospital on May 29, 1911, with the history that about three years before he first saw blood in his urine. Cystoscopic examination showed the bladder to be in fair condition, showing no evidence of gonorrhœal or tuberculous cystitis. A small sore was seen in the region of the neck of the bladder. The prostate was not enlarged. The bladder was washed frequently, but in spite of this the urine occasionally showed the presence of blood.

About a year and a half ago the patient had an acute illness, with bloody urine, fever, and gastro-intestinal disturbance. His temperature rose to 106.5° and his urine was thick and yellow. During this attack he passed a cylindrical plug, white in color and hard in consistency. After this his temperature dropped immediately, but he has had similar milder attacks since. A week before admission physician told him that pus was present on catheterization of the ureters.

He had to be catheterized daily, and was able to void, with pain, only small quantities of urine. He had a slight urethral discharge, and complained of pain of moderate intensity in the right side. He ate fairly well, and his general appearance improved. On June 25, his temperature, which had been normal,

rose to 103.6° within twenty-four hours; he complained of pain in the right flank and looked acutely ill. A few days later rigidity was noted in the epigastrium and slight rigidity in the right flank. After running a septic temperature for five days his temperature dropped to normal, local signs disappeared, and the patient was able to be up and about, and was apparently gaining in strength. About July 10 he began to complain of a sudden pain in the neck of the bladder on voiding. At the same instant the flow stopped, except for a little dribbling.

On July 15 an X-ray was taken, which showed a strawberry-sized shadow in the right kidney, which Dr. Caldwell regarded as a calculus. Two days later this diagnosis was verified by Dr. Woolsey, who operated and removed a stone about the size of an almond from the pelvis of the right kidney through a posterior incision of the pelvis. It was hard and smooth. During the operation, it was noted that there were many fibrous adhesions over the pelvis. The patient made an uneventful recovery, and ten days later the urine was normal, with the exception of a considerable number of pus-cells, which had been present prior to the operation. The patient was voiding from 46 to 60 ounces of urine daily, without any obstructive symptoms, although he still complained of a dragging pain in the right flank. The symptoms indicating the presence of a vesical calculus reappeared when he was up out of bed. As there was no shadow in the bladder region in the X-ray he was again cystoscoped by Dr. Stevens, and a small stone was found. An unsuccessful attempt was made to remove this by the Bigelow evacuator, and two days later Dr. Hartwell removed the stone by perineal cystotomy. The further recovery of the patient was uneventful, and he left the hospital on August 17, 1911.

BENIGN STENOSIS OF THE PYLORUS; GASTROPTOSIS.

Dr. George Woolsey presented a woman, 65 years old, who was transferred from the medical side of the Presbyterian Hospital on September 25, 1911. The history she gave was that for the past 20 years she had suffered from gastric distress and distention, with eructations of gas and occasional attacks of vomiting. She had also suffered from chronic constipation, with pain in the epigastric, umbilical, or right lumbar regions, often

radiating through to the back or to either shoulder. Since December 26, 1910, these attacks had become more severe, and the vomiting had become more frequent. Her symptoms usually began within an hour after eating, and the pain and distress became so severe that the patient was confined to her bed for weeks at a time. The stools were frequently tarry; the vomitus was coffee-ground at times, and on several occasions had contained particles of fruit and green vegetables ingested several days before. The patient had lost about 30 pounds in weight during the preceding eight months.

An examination after insufflation of the stomach showed that the lesser curvature was one inch above the umbilicus, and the greater curvature three inches below. There was visible peristalsis, which was evidently due to pyloric obstruction. A gastric analysis showed a total acidity of 60 c.c., with 32 c.c. of free hydrochloric acid, and an absence of lactic acid. Blood was present.

On September 25, 1911, Dr. Woolsey did a no-loop gastrojejunostomy and gastropexy. The pyloric ring was found to be much thickened and contracted, especially anteriorly, where there was the puckered scar of a healed ulcer. There was marked gastroptosis, but no evidence of malignant disease. To prevent traction on the jejunal loop, the stomach was held up to about the level of the umbilicus by two silkworm gut sutures which were passed transversely, each suture taking three bites of the stomach wall (Rovsing's method). These sutures were removed after 10 to 14 days.

The patient made an uneventful recovery from the operation, and was discharged, cured, on August 10, 1911. Since then she has gained much in flesh and strength, she has no gastric trouble, and looks and feels like another woman. The interesting feature was the gastropexy, which was only done to avoid traction on the suture line and the danger of tearing it out. The gastropexy caused no pain or trouble while the patient was in bed or after she was up and about.

FIBROMA OF THE POPLITEAL SPACE.

Dr. George Woolsey presented a woman, 24 years old, who was admitted to the Presbyterian Hospital on July 13, 1911, with the history that about two years before she first noticed gradually

increasing stiffness of the posterior aspect of the right knee on flexion, and about a year later she felt a mass in that region. This gradually grew larger, and nine months ago an operation was done at which only fatty tissue was said to have been removed, and which gave her no relief. There was gradually increasing pain and swelling, and the incision of the operation healed very slowly.

Examination showed a large, hard, deeply-seated, immovable mass in the right popliteal space. It was not very tender; no redness nor heat. Motion of the affected limb was limited, but not very painful, the pain being limited to the popliteal space and down the leg. An X-ray was taken, which showed no connection between the tumor and the bone.

Operation, July 13, 1911, by Dr. Woolsey: A long longitudinal incision was made through the deep fascia, disclosing the external popliteal nerve, which lay quite superficial and was displaced slightly outward. The internal popliteal nerve was much displaced posteriorly; it was separated from the vein by the tumor and lay in a deep groove in the upper end of the tumor. The latter was quite adherent to the vessels, especially to the popliteal vein, and to avoid injury to the vein, the femur was divided into three segments before its removal. It was also very adherent to the inner head of the gastrocnemius, so that a thin layer of the inner head of that muscle had to be removed with it. The tumor was about the size of a large grape-fruit. The space left after its removal was drained by two cigarette drains. With the exception of these openings the wound healed *per primam*, and the patient made an excellent recovery. A few days after the operation there was some swelling of the leg, together with a feeling of numbness and tenderness, especially along the course and distribution of the external popliteal nerve. These symptoms persisted for some time, and walking was at first painful because it necessitated the stretching of the gastrocnemius as the heel was drawn up, so that she walked on the toes. But gradually, under passive motion and massage, the heel was brought down, and she had no further trouble. Pathologically, the growth proved to be a fibroma.

SUBPHRENIC PERINEPHRITIC ABSCESS.

DR. WOOLSEY presented a boy, four years old, who was admitted to the Presbyterian Hospital on September 22, 1911, with the history that for a month prior to that time he had not been feeling well.

Examination showed a slight fulness in the right flank, and palpation gave a sense of resistance and the presence of a firm mass, about the size of an orange, which extended down about to McBurney's point. It was moderately tender, not movable nor moving with respiration, and did not fluctuate. The case was regarded as one of abscess of a high appendix, and on September 22 Dr. McWilliams and the house surgeon exposed the appendix, which was found slightly congested but practically normal in gross appearance. There was a firm, non-fluctuating mass felt as if springing from the anterior border of the liver in the anterior axillary line, and extending thence outward, downward, and to the right, where it was firmly attached to the lateral wall of the abdomen. It was apparently extraperitoneal, about four inches in diameter, and projected about an inch or more into the abdominal cavity. Its surface was smooth, with some irregularities over the lower part. The mass was regarded as a possible gumma of the liver.

At the time of the patient's admission, a blood count was made, which showed 24,800 white blood-cells, with 86 per cent. of polynuclears. Two days after the operation, the white blood-cells numbered 26,100 and the polynuclears 86 per cent. His temperature, which was 103.4° on the day following the operation, gradually fell to normal, but the abdominal distention, pain, and local tenderness in the right lumbar region were unrelieved. Wassermann reaction negative.

On September 27, Dr. Woolsey made a two-inch incision just below and parallel to the ribs, over the mass. A needle was inserted, which withdrew pus. The opening was then enlarged, and two ounces of pus evacuated. The mass proved to be a perirenal subphrenic abscess extending up to the postero-inferior border of the liver. This was drained, and the further recovery of the patient was uneventful. He left the hospital, cured, on October 27, 1911. Cultures from the pus and from the throat gave a pure culture of *Staphylococcus aureus*. The urine was practically normal.

NEPHROLITHIASIS OF THE KIDNEYS; CALCULUS IN LEFT URETER; SINUS OF LEFT KIDNEY.

DR. WOOLSEY presented a woman, 49 years old, who was admitted to the Presbyterian Hospital on July 17, 1911. She gave a history of having had mild pains in the kidney regions for 20 years prior to March, 1906, when she was operated on at Bellevue Hospital, where three stones, including a large, pipe-stem one, were removed from the right kidney. The kidney consisted of a thick shell containing several large pus pockets. Her pain persisted, and an X-ray showed stones in both kidneys. Right nephrectomy was planned, but a ureteral catheterization showed that the right kidney was apparently the better of the two. In November, 1906, the patient was again operated on, this time at the Presbyterian Hospital, where one stone, the size of an olive pit, and several smaller ones were removed from the right kidney. At this time, two small pockets of pus were opened, and the kidney was drained. On the sixth of the following month the left kidney was opened, and three or four calculi removed. This kidney was found to be much enlarged, adherent, and filled with pockets of thick, greenish-yellow, foul-smelling pus. After this operation, a sinus persisted for nearly a year. The wound on the right side had healed readily, and the patient gradually gained in strength.

Following the above operations, the patient had occasional slight attacks of pain in the right lumbar region, and eight days before her recent admission to the hospital she was seized with a sharp, severe pain over the old wound on the left side, followed by the appearance of a hard but not very tender mass. On the day of her admission, this swelling broke, and with the spontaneous evacuation of a large quantity of greenish pus, her pain ceased. An X-ray showed stones in both kidneys, more pronounced on the left side, and there was also a stone in the left ureter at the brim of the pelvis. In the middle of the left lumbar scar there was a small sinus discharging yellow pus, without urinous odor. On bimanual examination, a mass twice the size of the kidney was felt in the left upper quadrant. It could be pushed forward from behind, was firm and smooth, and not very tender. The acute onset of the painful swelling was probably due to the blocking of the left ureter by the calculus.

On July 28, 1911, Dr. Woolsey opened the old scar, evacuating three pockets of pus and partly freeing the kidney from adhesions, but these were so dense that he was unable to deliver it into the wound. The kidney was thereupon incised, and with some difficulty several phosphatic stones were removed, one the size of a robin's egg and two of bean size. The abscesses seemed to be outside of the kidney, which was very much altered and reduced to a thick shell. The wound was closed, with drainage.

The patient made a good recovery. The amount of pus in the urine gradually decreased, and under the use of urotropin, the reaction of the urine first became neutral and then acid. The wound was closing well and draining considerable urine, and the patient was able to leave for home on August 21, 1911. It is planned to remove the ureteral calculus, if necessary, at a future date.

The interesting feature of the case is that after the first three operations, all done by Dr. Woolsey, she became so well and strong that she has been able to do her housework for the past four years, though each kidney was a mere shell of a suppurating sac. Each kidney would have been removed, if the other had been healthy. The case serves to show how much may be done by conservative surgery in such cases, even when both kidneys are infected.

PERFORATING DUODENAL ULCER, COMPLICATED BY BILATERAL SUBDIAPHRAGMATIC ABSCESS.

Dr. Ellsworth Eliot, Jr., presented a man, 44 years old, who was admitted to the Presbyterian Hospital on March 6, 1911. For the past year he had complained of indigestion, with vague sensations of pain and oppression in the epigastrium, sometimes radiating to both shoulder-blades; these pains occurred from two to four hours after meals and were relieved by taking food. He also suffered from gaseous eructations, and occasionally vomited a greenish fluid.

On the day prior to his admission he had a sudden attack of pain, severe and colicky, in the epigastric region; this radiated to the left and was persistent. There was no history of vomiting; the bowels had not moved for 48 hours, and two enemas had been given without result. Upon admission, the abdomen was found moderately distended; it was very rigid, especially in the right

upper quadrant, with generalized tenderness and tympany, except in the right flank, where dulness, as far forward as the edge of the rectus, could be elicited. A rectal examination was negative. The patient's temperature was 99.5°; pulse, 116; respirations, 24. A blood count, made on March 7, showed 7000 white blood-cells, with 88 per cent. of polymorphonuclears. The urine contained a heavy trace of albumin and many casts.

Operation: 36 hours after perforation under ether anæsthesia, the peritoneal cavity was opened through an incision parallel to the upper outer margin of the right rectus muscle, enlarged by a second incision extending at right angles to its upper extremity toward the median line. There was an immediate gush of a large quantity of turbid, dark-colored fluid, containing gastric and duodenal contents completely filling both subdiaphragmatic spaces, the space between the left lobe of the liver and the abdominal wall and the right lower half of the peritoneal cavity, together with the pelvis. The fluid was thicker, more gummous, and more offensive about the pyloroduodenal junction than at the more distant parts. A perforation in an indurated ulcer the size of a 25-cent piece was found in the anterior upper wall of the duodenum just beyond the pylorus. It was closed with a purse-string suture, reinforced by two Lemberts.

The peritoneal cavity was cleansed by general irrigation. Cigarette drains were introduced into either subdiaphragmatic space and through the suprapubic opening below into the pelvis. The abdominal incision was then rapidly closed by suture.

The patient made an excellent recovery from the anæsthesia. For a week the drainage was satisfactory. The discharge from the pubic opening was serous and the opening rapidly closed after removal of the drain on the fifth day. The discharge from the upper opening was purulent, thick, and offensive, and in this situation the sutures did not hold, the wound healing slowly by granulation. At the end of 10 days the temperature and blood count indicated pus retention, and as the patient's condition did not warrant a posterior transpleural counter-opening, the device of attaching siphon drainage to a catheter introduced into the left and right subdiaphragmatic space was adopted with excellent results. The sinuses ultimately closed. The one between the left lobe of the line and abdominal wall, which was the least deep, was the last to heal. Three months after the operation a stomach analysis

showed no hyperacidity. There has as yet been no recurrence of any ulcer symptom.

RESECTION OF INTESTINE IN STRANGULATED FEMORAL HERNIA.

Dr. Ellsworth Eliot, Jr., presented a woman, 61 years old, who was admitted to the Presbyterian Hospital on January 15, 1911. Her family history was negative, and her past history had no bearing on her present illness, which had its onset six days before, beginning with cramps in the abdomen, with constipation, and followed by vomiting. The vomitus consisted of large quantities of bad-tasting, brownish fluid, and it occurred about once or twice daily. The patient complained of extreme thirst. Upon admission, her temperature was 98°; pulse, 112; respirations, 24. There had been no passage of either gas or fæces for six days.

Upon examination, the abdomen was found to be moderately distended, especially over its lower half. There was no visible peristalsis. In the right femoral region there was a mass about the size of a hen's egg. This was irreducible, not painful, and dull on percussion. The overlying skin was normal.

Operation: The sac of a femoral hernia, exposed through a vertical incision, was found to contain blood-stained fluid with a loop of necrotic small intestine. A second incision was then made, just above Poupart's ligament, as in the McBurney muscle-splitting operation for appendicectomy, and the loop of small intestine passing through the hernial opening quickly identified. The constriction was then relieved by division of Gimbernat's ligament from below and the liberated loop rapidly withdrawn through the intermuscular incision. A resection with end-to-end anastomosis by suture was then carried out in the usual way. In case of leakage the intestine was sutured with one catgut suture to the edge of the parietal peritoneum and the incision closed with a small rubber tissue gutter passing to a point just within the cavity.

The patient made an excellent recovery with the exception of an intestinal fistula, which developed on the fifth day and after the fifteenth day closed spontaneously. The hernial incision healed primarily.

LIGATION OF COMMON CAROTID FOR PULSATING EXOPHTHALMOS.

DR. ELIOT presented a man, 51 years old, who was admitted to the Presbyterian Hospital on October 15, 1909. His family history was negative. The patient had been addicted to the moderate use of beer and whiskey. Over 30 years ago he had an attack of gonorrhœa. Ten years ago a piece of steel entered the right cornea, resulting in ulceration and partial loss of sight of the right eye.

Present illness: Five weeks prior to his admission to the hospital, the patient was assaulted by three men, receiving a blow over the left zygoma with some heavy instrument. After a brief period of unconsciousness, with bleeding from the mouth and nose, which was fractured, he was able to walk home. The left eye was swollen and nearly shut; this swelling gradually became less, and 17 days after the injury he had some use of the eye. Two weeks ago he first noticed that the left eyeball was protruding, and during the past week the under lid had become everted. With every beat of the heart there was a throbbing pain in the eye, and a murmur or buzzing sound could be heard distinctly in the left ear. The patient complained of pains of great intensity shooting from the left to the right side of the head. He was dizzy at times; no vomiting.

Examination showed marked exophthalmos of the left eye, which protruded to the plane of the orbital ridge and bridge of the nose. The eyelids were swollen, and between them was a red area of conjunctival tissue, one inch long and a quarter of an inch wide. On separating the lids, the conjunctiva about the iris was found to be swollen and crowded over it somewhat. The eye reacted slightly to light and accommodation. Its pulsations could be distinctly seen and felt, and a continuous blowing murmur could be heard over the entire skull and vessels of the left side of the neck; this sound was exaggerated with every heart beat, and was loudest over the left eye. An examination of the eye-ground showed marked swelling of the optic papilla, with œdema of the retina. The veins were enlarged and tortuous; the arteries small.

Operation: Ligation of the left common carotid, just above the omohyoid muscle.

There was no sign whatever of interference with the cerebral

circulation. The intracranial murmur ceased and the exophthalmos rapidly disappeared, so that at the end of ten days very little remained. At present, three years after operation, the eyesight has gradually improved and patient can use the eye in walking and in distinguishing objects at a distance. Continued use, in reading, results in headache. There is no suggestion of an interorbital swelling.

On November 2, 1909, when the patient was discharged from the hospital, the exophthalmos had largely receded, and the left eye was but little more prominent than the right. The swelling of the lids had disappeared, so that they were able to close over the eye, but there was still some redness and congestion. The patient was able to count fingers with the left eye at a distance of ten feet, but the sight of the eye was still much impaired. The sight was gradually improving and the pain was much less severe. The murmur heard over the cranium had disappeared. The patient still complained of slight pain in the occipital region.

Dr. Gibson showed photographs of a case where he had ligated the common carotid in 1904. In that case there had been some intracranial operation, during the course of which some trauma was inflicted, and further operative measures had to be abandoned on account of very severe hemorrhage. When Dr. Gibson first saw the patient, the eyes were bulging, and the sight of one eye was lost. He tied the common carotid, and in the course of time the patient recovered entirely, so far as the restoration of the usual appearance of the eye was concerned.

MEGACOLON.

Dr. Joseph A. Blake presented a woman, aged 24 years, who was admitted to the Presbyterian Hospital January 18, 1911, and discharged March 28, 1911.

Her history before admission to the hospital was, briefly, that of chronic constipation for three years. Shortly after this commenced she had noticed a mass about the size of an egg in the left lower quadrant of the abdomen. This mass has gradually increased to its present size. Four years before admission the patient had been laid up for nine weeks with what was said to be "kidney trouble," at which time she had general anasarca.

Physical examination on admission revealed a marked bulging of the left flank. Upon palpation a mass the size of a child's head

was felt in the left lower abdomen, freely movable from side to side, but not so freely upward. The mass was not tender, and on pushing it up the uterus seemed to be elevated. On this account a presumptive diagnosis of ovarian tumor was made.

The abdomen was opened by a median suprapubic incision, and a marked enlargement of the large intestine was found confined to the descending sigmoid colon and the upper part of the rectum. The wall of the colon was much hypertrophied. The mesocolon was so long that the sigmoid could be lifted for at least fifteen inches outside the abdomen.

Considering the fact that the increase in the diameter of the colon extended well down into the rectum, it was deemed inadvisable to do an end-to-end anastomosis; so the mesocolon, having been divided and ligatured, as much of the colon was drawn from the abdomen as would at the same time permit of easy approximation of the descending colon with the rectum. These were then sutured together at their mesenteric attachments. The protruding limit of gut was then left intact in the lower angle of the wound until the remainder of the wound had been closed. Each limb was then clamped separately and divided beyond the clamps with a cautery. A tube was then introduced proximal to the clamp in the oral limb and surrounded by a purse-string suture. Thus a complete artificial anus was created, which was finally closed by cutting out the spur with an enterotribe and then closing the remaining fistula by a later operation. An examination of the specimen removed was made by Dr. A. D. Whipple, who reports as follows:

Macroscopical.—The specimen consists of part of the descending and sigmoid colon. In length it is 120 cm. (48 inches). The greatest circumference is 42.5 cm. (17 inches). In the lumen of the descending colon is an enterolith weighing 980 gm. which measures 14.5 x 10.5 x 11 cm. This fecal mass contains melon and grape seeds, beans and much amorphous detritus. The centre of the mass is almost dry.

The entire specimen shows marked thickening of the intestinal wall, most pronounced in the sigmoid portion below the enterolith. The hypertrophy of the muscular coats, particularly the inner circular, is very noticeable. The muscular coats in the sigmoid measure 3 mm. compared to the normal diameter of 1–1.5 mm. The mucosa is also thickened, measuring 1 mm. in places. In the muscular border there is a very noticeable dilatation of the vessels. The appendices epiploicæ are very large. Lymph-nodes in the mesocolon are numerous and larger than normal.

Microscopical.—The number of villi in a given area—1 sq. mm.—in different sections from the mucosa of the transverse colon appears to be fairly constant, and this number compared with the number of villi in equal areas in sections taken from two specimens of colon removed for carcinoma of the sigmoid, as well as from a normal colon, is approximately the same. An Ehrlich eye-piece with the stage micrometer was used in counting the villi.

This would indicate an increase in the number of villi commensurate with the increase in size of the entire colon.

There is some round-cell infiltration of the mucosa with enlargement of the small vessels between the villi.

As in macroscopic examination, the two muscular coats and serosa show marked hypertrophy. The lymph-nodes show simple hyperplasia.

The count of the villi is interesting, showing that the villi were increased in number so that the same number of villi existed as in a normal intestine. This places it in the category of congenital malformation of the intestine, and not a secondary enlargement.

Stated Meeting, held December 13, 1911.

The President, Dr. Charles L. Gibson, in the Chair

COIN LODGED IN THE ŒSOPHAGUS FOR SIX MONTHS.

Dr. Charles L. Gibson showed a child, 22 months old, who six months previously had suddenly developed difficulty in swallowing, the cause of the trouble not being known nor suspected. The child was admitted to the pediatric service of Dr. C. F. Collins at St. Luke's Hospital, and an X-ray was taken which showed a nickel coin lodged at the level of the fourth dorsal vertebra. The child was able to swallow fluids with moderate discomfort and nutrition was fair.

All attempts to grasp the coin by means of various modern apparatus failed, but with the coin catcher it was extracted with great ease and without any trauma. The child was now able to eat solid food without discomfort.

FRACTURE OF THE ZYGOMA.

Dr. Gibson presented a man, 22 years of age, who three weeks before operation fell against a sharp object, striking against the upper part of the cheek. The accident was followed

by immediate limitation of the movements of the lower jaw. On admission to the hospital there was pain and infiltration of the overlying tissue over the distal portion of the zygoma, and within ten days a depression of the soft parts became visible. By open incision, a V-shaped fracture of the zygoma, half an inch from the malar, was revealed, and the fractured bone was elevated into its correct position. Movements of the jaw at once became normal.

It was possible, Dr. Gibson said, that the limitation of motion of the jaw in this case might have improved in the course of time with conservative measures. Most of the recorded cases showed such a result.

MESENTERIC THROMBOSIS, WITH RESECTION OF OVER FIVE AND ONE-HALF FEET OF GUT

Dr. N. W. Green presented a woman, 43 years old, who was admitted to St. Luke's Hospital, on the service of Dr. Robert Abbe and Dr. Walton Martin, June 19, 1911. Her family history was unimportant, and her previous history had no special bearing on her present illness. This began one week before admission, when she ate some food which gave her a diarrhœa and cramps for two days, and on one occasion, three days before admission, she passed a black stool.

At 3 A.M. on the day of her admission she was awakened with severe abdominal pain one inch to the left of the umbilicus. This pain gradually increased in severity. It remained localized in the midabdomen, with tenderness in that region. She was given some medication, which was followed by nausea and vomiting.

As the patient's symptoms indicated the presence of an intestinal obstruction, an operation was decided on. This was done by Dr. Green sixteen hours after the onset of the pain. Upon opening the peritoneum, a litre of red fluid escaped. A coil of intestine, reddish-black in appearance, was found extending transversely and slightly upward from the left iliac fossa to above the ileocæcal region. The discoloration of this coil of gut was not uniform, being lighter in some places than in others. The mesentery was red and œdematous along its intestinal attachment. Over five and a half feet of the gut was resected, and after testing the remaining portions by cutting off additional

pieces four or five inches long until free bleeding was obtained, it was anastomosed with a Murphy button, reinforced with a Lembert stitch. The mucous membrane of the excised gut was quite black. The abdominal cavity was washed out with saline solution through a Blake irrigator, and the wound closed, with drainage, to the site of the anastomosis. The diagnosis was made at the operation and was materially aided by the similarity of the picture presented on the table to that of Dr. Schley's case of last year. The pathological examination showed thrombosis of the veins in the mesentery.

The button was discharged some weeks after the operation. A sinus persisted for several weeks, but finally healed, and the patient has resumed her work.

An interesting point is that although during her convalescence she suffered from an intercurrent apical bronchitis, she has gained 35 pounds since her discharge from the hospital.

Dr. Winfield S. Schley said that some months ago, in the medical service of Dr. Theodore C. Janeway at St. Luke's Hospital, he saw a case similar to the one shown by Dr. Green, and had operated. The patient was a man who evidently had some serious intra-abdominal condition, and while no positive diagnosis was made, a laparotomy was clearly indicated and he was transferred to the First Surgical Division. Upon opening the abdomen a mesenteric thrombosis was discovered. On section of the mesentery the arteries bled but the veins were thrombosed. The abdomen was filled with bloody serum from the diapedesis of the red blood-cells. The black-red gut was excised together with several inches of healthy intestine, beyond lines of demarcation, some 22½ inches altogether being removed. An immediate end-to-end anastomosis was done. This patient made a perfect recovery. These cases of mesenteric thrombosis, Dr. Schley said, were perhaps somewhat more common than we had been led to believe. They could be divided into two groups, the acute cases and the chronic cases. The former were almost invariably fatal and were of more frequent occurrence than the chronic cases. In 214 cases collected by Jackson, Porter, and Quinby from the records of the Massachusetts General Hospital and other sources, 47 per cent. were operated on with a mortality of 92 per cent. The mortality in this acute variety is undoubtedly increased by faulty diagnosis, delayed operation,

and imperfect technic. One fatal case showed but an inch of involved gut and would almost surely have recovered with operation. The chronic cases might last for months or years and the true condition only be recognized at autopsy, or the latter might disclose a condition that had never given rise to symptoms or been suspected during life. The occlusion of a large vessel might occur without lethal termination, provided the process was very slow.

The President, DR. GIBSON, said he was rather inclined to think that this condition of mesenteric thrombosis was more frequent than we had been led to believe. Personally, he had seen four cases, two of them in his own practice. In one of the latter, the diagnosis was verified by operation and in the other by autopsy. In one of these cases, where he had made the diagnosis before opening the abdomen, in addition to the vomiting, distention and pain, there were evidences of intestinal obstruction, but the obstruction was not complete, and this he thought was a distinguishing feature in all of these cases, nor did we get the characteristic blood picture of a spreading peritonitis. In the case he had in mind, there was a practically level blood line; this and the pain in the back were very suggestive.

FIVE CASES OF GRAVES' DISEASE.

DR. JOHN ROGERS showed these cases to illustrate variations in the pathology and treatment of different forms of Graves' disease,

CASE I.—This was a Swiss seamstress, 50 years old, who gave a history of goitre existing for the past 25 years. Five or six years ago, following a strenuous period of night work and insufficient nourishment, the typical signs of Graves' disease, but without exophthalmos, began to appear, and continued with more or less interruption, apparently depending upon rest and ease or fatigue.

She first came under observation in December, 1909, and complained chiefly of dyspnœa on exertion, insomnia, vasomotor irritability, and weakness. Pulse was 110 and blood-pressure 170. There was an irregular, nodular goitre with some stridulous breathing, which indicated pressure on the trachea. These symptoms were all relieved by feeding a preparation of the adrenal proteids and enforcing more or less hygiene, but the blood-

pressure could not be reduced lower than 145. The unavoidable pressure of work and worry incident to her occupation, however, produced frequent recurrences of the signs of thyroidism, and in 1910 headache became more or less troublesome.

Therefore, on July 25, 1911, a radical operation was undertaken under nitrous oxide anæsthesia. The chief enlargement of the thyroid and the greatest pressure on the trachea seemed to be on the left side, and this lobe was removed first together with the isthmus. When it was turned out on the neck, the trachea collapsed and the imminent danger of asphyxia was avoided by pulling the trachea open with a tissue forceps attached to its most collapsed portion. It was then found that a substernal nodule on the right side had produced an S-shaped deformity of the trachea, and this part of the goitre was below the clavicle. This was then turned out by the finger introduced next to the trachea, but in lifting this part of the gland up the organ tore across in the middle of the right side. In controlling the hemorrhage, considerable more of the thyroid was sacrificed, and at the close of the operation there was left only a small nodule about an inch and a half in diameter at the upper pole of the right lobe. The trachea was sutured to the deeper muscles and fascia of the neck with catgut to keep it open. The pulse-rate had risen to 140 at the conclusion of the rather bloody operation, but at the end of two or three days all alarming symptoms had subsided, although the anæmia required some weeks to disappear. Patient left the hospital at the end of three weeks, and now is conscious of no abnormality. There is some headache, however, after fatigue, and the pulse-rate is slightly irritable but averages about 80. The blood-pressure averages 170. There seems to be a necessity of a moderate amount of feeding with the thyroid proteids to relieve the so-called fatiguability and the tendency to constipation. The headaches in these cases of manifest thyroid disease are a great puzzle, as some of them are relieved by operation and some are made worse. This first case also shows that a very small amount of thyroid tissue seems to be sufficient in older patients. It certainly is not sufficient in those who are under thirty. In other words, radical operation upon the thyroid is much better borne after middle life than before it, and more thyroid tissue can be sacrificed in age than in youth without serious consequences. It is also noticeable that this

patient, at present, does not do well on the adrenal feeding which seemed extremely beneficial before the thyroidectomy.

CASE II.—A man of 24 years, who first came under observation in June, 1910, with a very severe condition of typical exophthalmic goitre. There was pronounced exophthalmos and a large, symmetrical goitre. Pulse of 140, with a blood-pressure of 110 and great emaciation. He had been treated in the medical ward for the previous six months with the antithyroid serum, and had recovered partially from an acute toxæmic thyroidism. This followed a period of strenuous night and day work as a telegraph operator. After a couple of months of anti-serum treatment, the blood pressure would rise to 140 or 150 following each injection, and the symptoms were made worse instead of better.

Therefore, on July 13, 1910, under novocaine anæsthesia, the left superior and the right inferior thyroid vessels were ligated; and on July 22, the right superior and the left inferior were similarly treated. This was followed by considerable improvement, and in September the neck had decreased three inches in circumference but the blood-pressure was found to average 160 to 170. He was then placed upon a preparation of the adrenal proteids, as in the previous case, and immediately began to gain in all respects, and the blood-pressure slowly decreased. In July, 1911, a year after the operation, during which period he led a most hygienic mode of life with the constant administration of the adrenal proteids, the pulse-rate averaged 70 to 80, the blood-pressure was 150, the exophthalmos had disappeared, and the only abnormalities were moderate soft goitre and rather marked asthenia. This asthenia and the size of the goitre increased immediately if the feeding with the adrenal proteids was omitted for even one day. There has been a gain of 40 pounds in weight since the operation. At present the only abnormality is the moderate-sized soft goitre.

CASE III.—A married woman of 23 years, who first came under observation in December, 1910. She had suffered from typical exophthalmic goitre for five or six months. This followed a rather strenuous period during which she bore a child and did the housework for a large family of relatives. There was a large, firm, symmetrical goitre with exophthalmos, and pulse-rate of 150 and blood-pressure of 120.

On December 23, 1910, under novocaine anæsthesia, the two superior and right inferior thyroid vessels were ligated. There was a severe reaction to this operation, which was quieted by a single dose of the antithyroid serum. On January 7, 1911, the left inferior thyroid artery was ligated under local anæsthesia. This was followed by a slight but steady improvement, and in the spring she went to Europe and was much benefited, apparently, by the change and rest. At present, the only abnormality is a somewhat irritable pulse-rate and a small soft goitre. The important point in this case is that she is now three months pregnant and shows no pathological manifestations except that she is somewhat fatiguable. This curious asthenia, so characteristic in these thyroid cases, seems to be entirely relieved by feeding with a fiftieth of a grain of the combined thyroid proteids four times a day. This third case, by the way, has gained nearly fifty pounds since the operation.

Case IV is more recent and is a young girl of 16 years who has suffered from typical exophthalmic goitre of a severe grade for about one year. It seemed to develop after she had grown rapidly and had taken a position as a cash girl in a department store where she had very fatiguing work. She first came under observation in August, 1911, with a pronounced exophthalmos, and a large, firm goitre, which showed extreme vascularity. The pulse-rate was 150, the blood-pressure 120, and the weight was ninety pounds although she was five feet ten inches tall. There was rather noticeable brownish pigmentation of the whole body. This represents one of the severest forms of the disease.

On August 7, 1911, the left superior and right inferior thyroid vessels were tied, under local anæsthesia, and on August 14 the right superior and left inferior vessels were similarly treated. A month later on attempting to get out of bed there was a typical attack of tetany, which subsided when a fiftieth of a grain of thyroid proteids was administered every four hours. This thyroid feeding was followed by a very remarkable gain in weight of about four pounds each week. At present, she is still somewhat emaciated, but weighs 130, which is forty pounds more than when she first came under observation. She still shows some signs of thyroidism in the slight right exophthalmos and the average pulse-rate of 90 to 100.

Case V is a farmer of 45 years, who has been sick about

eight months with typical severe Graves' disease. This seemed to follow a period of unusual strain attendant upon care for a sick wife, a large milk farm, and several mortgages. When he first came under observation in November of this year, there was moderate exophthalmos, a pulse-rate of 130 to 150, a moderate-sized firm goitre, extreme emaciation, and asthenia.

On November 21, 1911, the right superior and left inferior thyroid vessels were tied, under local anæsthesia, and on December 1 the left superior thyroid vessels were similarly treated. There was an immediate and marked improvement in the pulse-rate, nervousness, and insomnia, but a troublesome dry cough developed, which could only be relieved by feeding a fiftieth of a grain of the thyroid proteids every four hours. There has been a gain of two or three pounds in weight each week, and the pulse-rate is now between 70 and 80 regularly, and hence it seems that it will be unnecessary to tie the remaining inferior thyroid vessel. If, however, any signs of relapse develop, the right inferior thyroid artery will be immediately tied.

The adrenal proteids referred to above are prepared in the same way as are the active ingredients from the thyroid gland. That is, the respective organs, generally the beef adrenals or the sheep thyroids, are hashed and suspended in salt solution for twenty-four hours, and the coarser particles are strained out through sterile filters, and the filtrate at a temperature of 40° to 50° C. treated with dilute acetic acid. The precipitate thus obtained represents the thyroid or adrenal proteids. In the case of the thyroid the proteids are standardized at the Loomis Laboratory according to their iodine content. The adrenal proteids are not standardized, but being treated in the same way each time are presumably closely alike in each preparation. They do not contain epinephrin, but a vasodilator instead of a vasoconstrictor substance.

The most obvious facts in these cases are their apparent origin in some fatigue process, and hence the presumable fatigue of the thyroid. This induces in the gland some alteration in its biochemical relationship with iodine which causes variations in both the quantity and quality of its secretion. The first requisite is to obtain rest for the thyroid, and this seems most safely and properly brought about by cutting off its blood and nerve supply. No more than two of the vessels, however,

can be tied at one sitting without considerable risk. The upper and lower vessels on opposite sides have been selected in these and other cases for operation, to avoid risk of paralyzing the phrenic, pneumogastric, and sympathetic nerves by the local anæsthesia. If both lower vessels were ligated at the same time, there is considerable risk of paralyzing the phrenics by the novocaine.

The inferior artery is reached by a two-inch incision along the outer border of the lower end of the sternomastoid muscle. The outer edge of the jugular vein is exposed, avoiding or cutting if necessary the external jugular, then the fascia at the outer edge of the external jugular is cut through, and the great vessels turned forward. By a little blunt dissection the inferior thyroid artery is found in the deep parts of the neck about one finger's breadth above the inner end of the clavicle, and tied where it passes transversely behind the common carotid. The inferior artery, by the way, is ligated with less pain than the superior, which has to be exposed by drawing aside the hyoid muscles. It is important in all these cases to excise the top of the thyroid lobes together with the vessels in order to cut all the blood supply. The superior thyroid vessels generally subdivide into several branches just before entering the gland, and it is quite easy to overlook one of these subdivisions unless half an inch of the top of the thyroid lobes is cut away. This excision of the top of the thyroid lobe gives much comfort to the patient subsequently, as without it there is considerable pain in swallowing for several days.

As evidenced by the necessity for adrenal feeding, and the very apparent benefit in certain cases, noticeably all those which have a blood-pressure of 140 and above, it seems probable that with the presumable fatigue of the thyroid there is a fatigue in the adrenal gland, which is known to be closely associated in its functional activity with the thyroid. The feeding with the adrenal as with the thyroid proteids is for the purpose of relieving the strain upon these organs, and by supplying a defect in the organism the nutrition is improved.

The surgeon's duty to these cases by no means ends with the operative interference, but they must be closely supervised for from six months to two or three years, during which time hygiene in the form of avoidance of fatigue and yet with the provision of sufficient exercise to maintain nutrition must be provided. In

addition, thyroid feeding below the point where it activates the thyroid itself can, in the majority of cases, be continued. Those which have a high blood-pressure cannot be benefited by thyroid feeding, but will be greatly helped by feeding with the adrenal proteids.

More extended reference to these preparations and the theories of treatment can be found in the *Journal of the American Medical Association* for September 2, 1911.

These cases, Dr. Rogers said, showed the results which could be obtained with suitable and cautious treatment. Graves' disease, with symmetrical goitre, could not be as safely and permanently relieved by partial thyroidectomy as by ligation of two or more vessels. The cases with asymmetrical goitres generally must have partial thyroidectomy performed, or at least enucleation of the diseased thyroid tissue. It was important to sacrifice as little as possible of the comparatively sound gland.

PARTIAL ENTEROCOLECTOMY FOR RECURRENT CARCINOMA, WITH REPAIR OF VENTRAL HERNIA.

Dr. Walton Martin presented a woman, 51 years old, who was admitted to St. Luke's Hospital, in the service of Dr. Samuel W. Lambert, on September 27, 1911. The history she gave was that in May, 1894, she was operated on by Dr. Paul Outerbridge at the General Memorial Hospital for a carcinoma of the transverse colon. The transverse colon, with the tumor, was resected, the divided gut being joined by a silver Murphy button. The hospital records stated that the tumor was as large as a fist, but there was no report of the microscopic finding. Dr. Outerbridge himself remembered the case, and believed that the growth was a carcinoma.

The patient made a good recovery, regaining her strength and normal weight. In a few years, however, she noticed a protrusion in the laparotomy scar. This gradually increased until it assumed very large proportions. She remained in good health, however, until two or three years ago, when she began to suffer from abdominal distention and gradually increasing constipation. She attributed these symptoms to her ventral hernia, but in May, 1911, she began to lose weight and strength and was obliged to give up her work. She was then admitted to Bellevue Hospital,

where she was told that she had tuberculosis, and tubercle bacilli were said to have been found in her sputum. While in bed, she discovered a movable, hard tumor in her abdomen. She left the hospital somewhat improved last summer, and in the autumn, as she was still weak and ill, she was admitted to the medical service at St. Luke's Hospital.

Examination at that time showed a fairly well-nourished woman. There was slight dulness at the apices of her lungs, and the aortic second sound of the heart was accentuated. The abdomen was lax and pendulous. There was a median scar from the xiphoid to just above the pubes, and in the middle portion of this scar was an opening through which a large mass protruded. This could be readily reduced. A firm, movable, slightly tender mass could be easily palpated in the right half of the abdomen. The patient's temperature was normal. The urine had a specific gravity of 1012 and contained a trace of albumin. Repeated examinations failed to show tubercle bacilli in the sputum, nor was there any cough.

After the woman had been under observation for several weeks, she was transferred to the surgical division for operation. On September 27, 1911, under ether, the old laparotomy scar, with the hernial sac, was excised, and the abdominal cavity opened. The ascending colon had a mesentery, and was freely movable. At the cæcal junction was a hard mass involving adjacent portions of the ileum and cæcum, and there were adhesions between the coils of the lower portion of the ileum. About ten inches of the ileum and four inches of the ascending colon, together with the adjacent portion of the mesentery, were removed. The divided ends of the gut were united by lateral anastomosis, a double layer of sutures being used for the purpose. The hernia was then repaired by lateral overlapping. After the overlapping of the muscles and fascia, the lax and pendulous skin was found to be redundant, and a semi-ellipse of skin was removed from each side of the lower quarter of the incision. The skin was sutured in the median line to this point, and then transversely, leaving an inverted T-shaped scar.

The section of the gut removed consisted of the lower 40 cm. of the ileum and the first 11 cm. of the colon, together with the appendix and the mesentery. In the cæcum and invading the end of the ileum was a hard tumor, 5 x 5 x 4 cm., white and

gritty on section. Its inner surface was ulcerated. Microscopically, it proved to be a gelatinous carcinoma.

The patient made an uneventful recovery from the operation. For several weeks afterward, however, she suffered from diarrhœa, having seven or eight movements daily. At present, these had been reduced to two or three.

Dr. Martin said the case seemed to be interesting on account of the possibility that the original growth, removed 17 years ago by Dr. Outerbridge, was a carcinoma, and that a recurrence had taken place in another portion of the intestine; also, on account of the considerable sections of the gut that had been removed, 18 inches being removed at the first and 20 inches at the second operation. The diarrhœa was presumably due to the interference with absorption in the cæcum and colon.

Dr. Lilienthal said that a number of years ago he showed a patient at one of the meetings of the Society where he had removed an adenocarcinoma of the hepatic flexure, followed by an enterocolostomy. For nine years that patient remained perfectly well, and then developed an inoperable carcinoma of the rectum.

It was probable, Dr. Lilienthal thought, that adenomata were of more common occurrence in the large intestine than we supposed, and that they frequently escaped attention until carcinomatous changes supervened, and this had led him to the conclusion that in dealing with an adenoma or tumor of any size involving the large intestine, he would in future make a careful exploration of the entire colon.

RUPTURE OF THE URETER, FOLLOWED BY EXTRAVASATION OF URINE AND SUPPURATIVE NEPHRITIS; NEPHRECTOMY.

Dr. Walton Martin presented a boy, eight years old, who was admitted to St. Luke's Hospital on May 8, 1911, in the service of Dr. Robert Abbe.

The history obtained was that six weeks previously he had been run over by an ice wagon, both wheels passing over the patient, who was lying on his stomach. He suffered from shock, but was not unconscious. Immediately after the accident, he vomited several times, and complained of pain in his back and lower abdomen. He was taken to the Harlem Hospital,

remaining there for several hours, and was then removed to his home. During the next two or three days he continued to vomit from time to time, and complained of pain in the loins. No blood was noticed in his urine, nor was any observation made of the amount of urine passed. Subsequent to this he improved somewhat and was up and about, but he still complained of pain in the lumbar region and had occasional attacks of vomiting. About a week before his admission to the hospital his mother noticed a large swelling in the left side of his abdomen.

Examination on admission showed a rather pale and poorly nourished boy. On the left side of the abdomen, from the free border of the ribs to Poupart's ligament, there was a smooth, slightly tender swelling, elastic and tense, over which a fluid wave could be plainly demonstrated. The examination was otherwise negative. The pulse-rate was 116; respirations, 20. The urine was negative. On the day of his admission, he passed fifteen ounces and on the following day nine ounces.

On May 12, 1911, under ether anæsthesia, the abdomen was opened by Dr. Abbe through a seven-inch incision along the left border of the rectus. A cystic mass, about the size of a foot-ball, was found. It was beneath the peritoneum and in the neighborhood of the left kidney. On puncture, a clear, odorless fluid was withdrawn. Two large drainage tubes were introduced into the cystic cavity, and gauze packed about the tubes. The abdominal wound was then closed.

On the following morning there was a urinous odor to the discharge from the wound, and from this time until August 7 the boy continued to drain urine from his abdominal wound. His temperature on the fourth day after the operation was 103° F., and he continued with an irregular fever; occasionally, he had a slight chill, followed by a sharp rise in temperature; he looked septic and lost weight.

On August 7, under ether anæsthesia, the left kidney was removed through a transverse incision. The kidney was slightly larger than normal, measuring 9 x 5 x 4 cm. The pelvis was smooth, pale, and apparently thickened. At the junction of the pelvis with the ureter there was dense scar tissue, and a sinus passed from this point to the incision of the previous operation.

Microscopical examination showed areas of kidney tissue infiltrated with pus, blood, and round cells; the tubules were

widely separated by an exudate; some were destroyed; the lumen of others was filled with pus and necrotic material. The boy made an uneventful recovery, and left the hospital at the end of seven weeks with the wound healed and the abdominal sinus closed.

Dr. Martin said there were but few cases of ruptured ureter reported. The late Dr. F. Tilden Brown, on October 12, 1904, presented a patient with a history almost exactly similar at a meeting of this Society.

Blauel in an article in the *Beiträge zur klinischen chirurgie,* in June, 1906, based his observations on twelve cases reported up to that time.

Dr. L. W. Hotchkiss, in connection with Dr. Lyle's case, said that in August, 1908, at Roosevelt Hospital, he had operated upon a negro who was brought in with a penetrating shot wound of the abdomen. Laparotomy was performed and it was found that the bullet had perforated both walls of the stomach and lodged in the back. These wounds were sutured and the abdomen closed. About two weeks later an abscess had developed in the left groin, and upon incision this was found to contain much urine, which made it clear that there was a wound of the left ureter. Operation, September 16, three weeks after injury, revealed the ureter completely divided by bullet and its distal end buried in scar tissue and with considerable loss of substance, so that it was impossible to do an anastomosis. The left kidney was therefore removed, and the patient made a good recovery. Shot wound of the ureter, Dr. Hotchkiss said, was an exceedingly rare occurrence.

EXTENSIVE EPITHELIOMA OF THE CHEEK, WITH SECONDARY INVOLVEMENT OF THE GENIAL GLANDS.

Dr. Henry H. M. Lyle presented a man, 52 years old, who was admitted to St. Luke's Hospital in September, 1910. He had a tumor of the left cheek, of eleven weeks' duration. Ten days previously his physician had incised the tumor, but no pus was found.

On examination, there was a large, indurated swelling occupying the left cheek and involving the angle of the mouth. In

the centre of the mass there was a discharging sinus. The buccal surface showed a cauliflower-like growth, which was not attached to the jaw. The submaxillary lymphatics were enlarged and hard. A section of the growth, removed for examination, showed it to be a squamous-celled carcinoma.

Operation: A wide excision of the growth, including the angle of the mouth, was made, and the defect closed by a modification of the Dowd operation, plus a flap taken from the neck. Primary union resulted. Ten days previously a block dissection of the neck and submaxillary and submental regions had been done.

Four months later, when the patient returned for observation, an examination showed that the mucoperiosteum of the jaw had become involved, and there were two distinct hard nodules on the cheek, one just below the centre of the malar bone; the second an inch lower down and posterior to the angle of the mouth. There was no cervical involvement.

At a second operation, virtually the whole cheek below the malar bone was removed, along with the fascia and fat covering the masseter. In this fascia, the buccinator and maxillary groups of the genial glands were found to be involved. The left half of the body of the jaw, with the involved mucous membrane of the floor of the mouth, was removed. Cutaneous flaps were obtained from the neck and the right side of the chin. Considerable difficulty was experienced, owing to the cicatricial tissue left from the previous operation. The buccal lining of these flaps was obtained by splitting the mucous membrane of the tongue and turning it upward, after the method suggested by Sonnenburg.

Three months ago a secondary plastic operation was performed to widen the cavity of the mouth, with good cosmetic and functional results.

Dr. Lyle said the points of interest in the case were: (1) the involvement of the genial glands, failure to recognize and remove these at the time of the primary operation having been the cause of the recurrence: (2) the use of a flap of mucous membrane from the tongue to line the cheek.

TREATMENT OF SIMPLE FRACTURES: SOME END RESULTS.

Dr. James H. Hitzrot read a paper with the above title, for which see page 338.

In connection with his paper, Dr. Hitzrot showed a number of patients and stereopticon illustrations.

Dr. George Woolsey said the worst cases he had observed were in transverse fractures of the long bones, especially the femur, in adults. In the cases of this type of fracture shown by Dr. Hitzrot, the reduction of the fracture was apparently excellent. But most of these were in children. In muscular adults it was by no means as easy, and in these cases, if complete reduction cannot be secured under anæsthesia, early operation, reduction, and plating are strongly indicated. Traction is inadequate in such cases if there is any overlapping. The speaker recalled two such cases in the femur in the last few years, treated by extension with a bad result, non-union, and much shortening. Open operation was required, and under such circumstances is far more difficult than in recent fractures.

Dr. Hitzrot, in closing the discussion, referring to transverse fractures, said he did not think that the direction of the fracture made as much difference as the time at which the attempt was made to reduce it. Those cases that were allowed to go untreated for three or four days were the ones that gave the most trouble, and if extension did not bring about the desired result within a week, it was impossible to reduce them by other non-operative means. These neglected cases were the ones that demanded early operation.

To Contributors and Subscribers:

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

Annals of Surgery,
227-231 South Sixth Street,
Philadelphia.

ERRATUM.

ARTERIAL SUTURING.

The illustration, Fig. 8, opposite page 211 of the February number of the ANNALS OF SURGERY, was reversed so that the legend below was incorrect. It should read:

"Fig. 8.—Three specimens of arterial suture from dogs. The lower specimen was removed in a few minutes after operation, the middle specimen two days after operation, the upper specimen thirty-three days after operation. The two lower specimens are carotid arteries, the upper one is a femoral artery. For further description see text."